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IX Response Action Contract



FIELD SAMPLING PLAN
FOR OMEGA CHEMICAL SUPERFUND SITE
OPERABLE UNIT 2
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

MONTEBELLO FOREBAY
LOS ANGELES COUNTY, CALIFORNIA



U.S. Environmental Protection Agency
Contract No. 68-W-98-225

CH2M HILL, Inc.

and Team Subcontractors:

URS Group, Inc.

E2 Consulting Engineers, Inc.

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EPA CONTRACT NO. 68-W-98-225
EPA WORK ASSIGNMENT NO. 175-RICO-09BC
CH2M HILL PROJECT NO. 183122

Prepared for
U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105

Prepared by
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July 2004



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Subject: Final FSP and QAPP for Omega Chemical Superfund Site Remedial
Investigation/Feasibility Study for OU-2

Dear Mr. Lichens:

Please find enclosed copies of the subject documents. Please contact me at 909-890-9857
if you have questions regarding this submittal.

Sincerely,

CH2M HILL

Tom Perina
Site Manager

Enclosures

c: David Taylor, U.S. EPA Region IX Quality Assurance Manager
Peter W. McGaw, ARCHER NORRIS

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U.S. ENVIRONMENTAL PROTECTION AGENCY REGION IX

Plan Title: Field Sampling Plan for Omega Chemical Superfund Site
Operable Unit 02 Remedial Investigation/Feasibility Study
Oversight

Site Name: Omega Chemical Superfund Site

Site Location: Whittier

City/State/Zip: Los Angeles County, California

Site EPA ID#: 09BC

Anticipated Sampling Dates: 2004 to 2005

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Acronyms and Abbreviations

AL	action level
ARARs	applicable or relevant and appropriate requirements
ARCH	air rotary/casing hammer (method of well drilling)
B	soil borings
bgs	below ground surface
BOD	biological oxygen demand
°C	degrees Celsius
CDM	Camp Dresser & McKee
CDWR	California Department of Water Resources
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-1,2-DCE	cis-1-2-dichloroethene
CLP	contract laboratory program
CPT	Cone Penetrometer Testing
COC	chain-of-custody
COD	chemical oxygen demand
CTR	California Toxics Rule
1,1-DCA	1,1-dichloroethane
1,2-DCA	1,2-dichloroethane
1,1-DCE	1,1-dichloroethene
1,2-DCE	1,2-dichloroethene
DHS	Department of Health Services
DO	dissolved oxygen
DQO	data quality objective
EC	electrical conductivity
EPA	Environmental Protection Agency
Freon 11	trichlorofluoromethane
Freon 113	trichlorotrifluoroethane

ft/ft	feet per foot
FB	field blank
FSP	field sampling plan
GAC	granular activated carbon
gpm	gallons per minute
HCl	hydrochloric acid
HPLC	high pressure liquid chromatography
IDW	investigation-derived waste
L/min	liters per minute
µg/L	micrograms per liter
MCL	maximum contaminant limit
mg/L	milligrams per liter
mL	milliliter
mL/L	milliliters per liter
MS	matrix spike
MSD	matrix spike duplicate
msl	mean sea level
MW	EPA monitoring wells
ND	non-detects
NDMA	n-nitrosodimethylamine
NTU	nephelometric turbidity unit
OPOG	Omega Chemical Site Potentially Responsible Party Organized Group
ORP	oxidation-reduction potential
OU	operable unit
OW	OPOG monitoring wells
PCB	polychlorinated biphenyl
PCE	perchloroethylene (tetrachloroethene)
PHG	public health goals
PID	photoionization detector
PP	push-probe sampling
PRP	potentially responsible party

PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act of 1978
RFA	request for analyses
RI/FS	remedial investigation/feasibility study
RPM	remedial project manager
RSCC	Region IX Sample Coordination Center
SVOC	semivolatile organic compound
1,1,1-TCA	1,1,1-trichloroethane
1,2,3-TCP	1,2,3-trichloropropane
TCE	trichloroethene
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TPH-d	total petroleum hydrocarbons-diesel
TPH-g	total petroleum hydrocarbons-gasoline
trans-1,2-DCE	trans-1,2-dichloroethene
TSDF	treatment, storage, and disposal facility
TTLC	total threshold limit concentration metals
USA	Underground Service Alert
VOA	volatile organic analysis
VOC	volatile organic compound
Weston	Weston Solutions, Inc.

SECTION 1

Objectives

This Field Sampling Plan (FSP) has been prepared to support the U.S. Environmental Protection Agency (EPA) in conducting a remedial investigation/feasibility study (RI/FS) for the Omega Chemical Superfund Site Operable Unit 2 (OU-2). Field activities under this investigation will include soil and soil gas sampling, installation and sampling of new groundwater wells, sampling of existing EPA and potentially responsible party (PRP) monitoring wells, and aquifer testing. This FSP was developed in accordance with EPA Region IX, *Guidance for Preparation of a U.S. EPA Region IX, Field Sampling Plan for EPA-Lead Superfund Projects* (EPA, 1993).

1.1 Background

The Omega Chemical Corporation (Omega) is a former refrigerant/solvent recycling operation located in Whittier, California, a community of approximately 85,000 people (Figure 1-1) (all figures located at end of respective section). The facility is located across the street from a residential neighborhood and within 1 mile of several schools, including three elementary schools and two high schools. The facility operated as a Resource Conservation and Recovery Act (RCRA) solvent and refrigerant recycling and treatment facility from approximately 1976 to 1991, handling primarily chlorinated hydrocarbons and chlorofluorocarbons. Drums and bulk loads of waste solvents and chemicals from various industrial activities were processed at Omega to form commercial products. Chemical, thermal, and physical treatment processes were reportedly used to recycle the waste materials. Wastes generated from these treatment and recycling activities included distillation column (still) bottoms, aqueous fractions, and nonrecoverable solvents. Additional data regarding site history and past investigations and remediation activities are discussed in detail in the *Final On-Site Soils RI/FS Work Plan* (Camp Dresser & McKee [CDM], 2003) and the *Omega Chemical Superfund Site; Whittier, California; Phase 2 Groundwater Characterization Study Report* (Weston Solutions, Inc. [Weston], 2002).

Chlorinated hydrocarbons (primarily perchloroethylene [PCE], trichloroethene [TCE], 1,1-dichloroethene [1,1-DCE], cis-1,2-dichloroethene [cis-1,2-DCE], and chloroform) and Freons (trichlorofluoromethane [Freon 11] and trichlorotrifluoroethane [Freon 113]) were identified as the primary chemicals of concern in soil and groundwater directly beneath the site. Elevated total chromium also was reported in groundwater beneath the Omega site. Perchlorate contamination is suspected. Other contaminants of concern (detected or suspected at the site) include cyanides, n-nitrosodimethylamine (NDMA), pesticides and polychlorinated biphenyls [PCBs], dissolved metals, and 1,4-dioxane. Elevated concentrations of chemicals of concern were also reported in groundwater west and southwest of the Omega facility, suggesting that a downgradient migration of the contaminant plume from the site has occurred.

EPA has divided the Omega Chemical Superfund Site into two Operable Units: OU-1 and OU-2. OU-1 includes the former Omega Chemical Facility property and extends a short

distance west-southwest approximately to Putnam Street (Weston, 2003). OU-2 surrounds the Omega Chemical Facility and extends offsite at least 2.2 miles to the southwest. The exact geographical extent of OU-1 and OU-2 has not been defined. OU-1 encompasses what is considered a "source area" at the former Omega Chemical Facility property. OU-2 includes contamination in groundwater that has originated from the former Omega Chemical Facility property and potentially also from other sites. The potential other source areas are also part of OU-2. One of the goals of EPA's investigation is to find the extent of OU-2.

1.2 Objectives

The scope of this FSP is to perform fieldwork associated with the OU-2 RI/FS on behalf of EPA. As stated in the EPA Work Plan (CH2M HILL, 2003), the overall objective of the field investigation is to collect data needed to fulfill the following Work Plan goals:

- Characterize the vertical and lateral extent of contamination and the subsurface hydrogeology within and at the leading edge (south and southwestern edge) of the OU-2 contaminant plume. Reports on remedial activities for contaminated sites other than the Omega facility will be reviewed and the information evaluated. Approximately 11 monitoring wells or well clusters (one to three wells at each location) and one extraction well will be installed as part of this investigation.
- Determine the hydraulic properties of the shallow contaminated aquifer at OU-2 by conducting a series of aquifer tests or slug tests at new and existing EPA and OPOG monitoring wells (OPOG is the *Omega Chemical Site Potentially Responsible Party Organized Group*).
- Confirm the nature and extent of groundwater contamination and monitor plume migration by conducting future quarterly and semiannual groundwater sampling and analysis of all new and existing EPA and OPOG groundwater monitoring wells for a period of 2 years.
- Obtain the information needed to evaluate contaminant fate and transport in the subsurface, to evaluate discharge options for treated groundwater, and to complete a baseline human health and ecological risk assessment.
- Establish a permanent groundwater monitoring network by installing new monitoring wells.

Additional investigation of potential source areas within OU-2, other than the Omega Chemical Facility, will be conducted, as necessary, when information on these areas becomes available. EPA and their consultants are currently performing a record search to identify and collect information on potential source areas within OU-2. Depending on the record search results, field investigation of some of the potential source areas may be warranted. This investigation will minimally include soil gas sampling, surface and subsurface soil sampling, groundwater monitoring well installations, and groundwater sampling. This FSP describes the field activities associated with groundwater sampling, groundwater monitoring well installation, and testing of wells for aquifer hydraulic parameters. Surface and subsurface soil sampling and soil gas sampling, if required, will be described in a subsequent FSP Addendum.

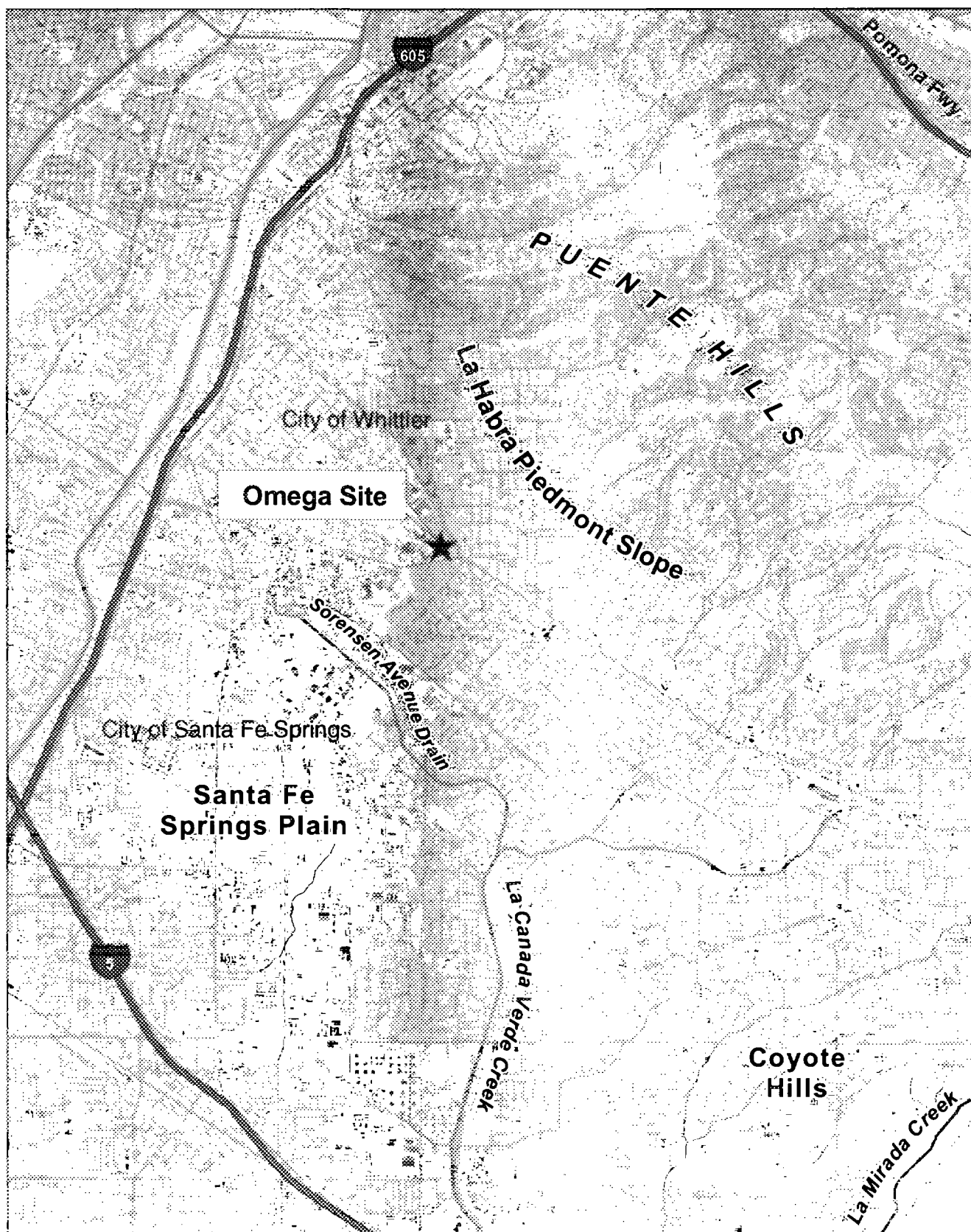


Figure 1-1
Site Location Map
Omega Chemical Superfund Site

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SECTION 2

Site Background

2.1 Location and Topography

The Omega Chemical Facility is located at 12504 and 12512 East Whittier Boulevard in Whittier, California (Figure 1-1). The City of Santa Fe Springs is located southwest of the site. The community of Los Nietos is included within the City of Santa Fe Springs. Unincorporated County of Los Angeles land is located northwest of the site.

The Omega Chemical Facility is located along the base of the La Habra piedmont slope descending from the southwestern flank of the Puente Hills, at an elevation of approximately 220 feet above mean sea level (msl) (Weston, 2003). The piedmont slope descends toward the southwest at a slope of approximately 2.5 percent to a point approximately 2,800 feet southwest of the Omega Chemical Facility. At this point, the ground surface flattens into a broad basin or plain, at an elevation of approximately 150 to 155 feet msl. In the southwestern part of the study area, the ground surface ascends a low rise at the northwest end of the Santa Fe Springs plain, at an approximate elevation of 160 feet msl (Weston, 2003). The site and surrounding areas are completely developed. The Sorenson Avenue drain is a small channelized drainage that flows southeast from the intersection of Dice Road and Slauson Avenue and becomes La Canada Verde Creek to the south of the OU-2 study area (Weston, 2003).

2.2 EPA Activities in the OU-2 Area

Data obtained in 1988 from site assessment activities, including groundwater and soil sampling conducted by the site owner/operator, Dennis O'Meara, and data from a preliminary assessment conducted by EPA in January 1995 (EPA, 1995a), indicated the presence of hazardous substances in subsurface soil and groundwater at the site, including methylene chloride, PCE, and TCE. The presence of these substances and deteriorated underground storage tanks at Omega led EPA to determine that an imminent and substantial endangerment requiring a removal action existed at Omega.

On May 3, 1995, EPA issued an Unilateral Administrative Order (EPA, 1995b) authorizing a Removal Action involving the following response actions:

- Securing the site
- Sampling and categorizing hazardous materials
- Removing hazardous substances and grossly contaminated equipment, structures, and debris
- Sampling surface and subsurface soils and groundwater to determine the nature and extent of contamination
- Disposing, stabilizing or treating grossly contaminated soils
- Grading, capping, and fencing contaminated soil areas

As part of the OU-1 effort, EPA entered into a Partial Consent Decree with the PRPs who had agreed to complete work at the site (OPOG). This Partial Consent Decree was entered into the District Court on February 23, 2001. OPOG agreed to perform an RI/FS, conduct a Non-Time Critical Removal Action, perform a risk assessment, and install groundwater monitoring wells at OU-1, also referred to as the Phase 1A area.

As part of the OU-2 effort, EPA issued an order to another group of PRPs to complete work at OU-2 and initiated settlement negotiations with the remaining PRPs. The resolutions of these actions are pending. The PRPs may perform a portion of the field activities described in this FSP, namely the well installation. In such case, CH2M HILL will provide oversight of the PRPs' activities. In the meantime, EPA authorized its consultant, CH2M HILL, to initiate the RI/FS at OU-2.

EPA is currently conducting the OU-2 RI/FS, and CH2M HILL is providing consulting services (including field activities) on behalf of EPA.

2.3 Hydrogeology

This section summarizes the site regional hydrogeological setting and site-specific hydrogeologic conditions.

2.3.1 Regional Hydrogeology

The following information on regional hydrogeological setting is largely based on the California Department of Water Resources (CDWR) Bulletin 104 (1961).

The site is located in the Central Basin of the Coastal Plain of Los Angeles County. The Coastal Plain is bounded on the west and south by the Pacific Ocean and by mountains on the north, east, and southeast. The Coastal Plain is underlain by an extensive groundwater basin in Los Angeles and Orange Counties.

Water-bearing sediments identified in the Whittier area extend to an approximate depth of at least 1,000 feet below ground surface (bgs). The identified geologic units consist of Recent alluvium, the upper Pleistocene Lakewood Formation and the lower Pleistocene San Pedro Formation. Figure 2-1 shows a generalized stratigraphic column of water-bearing sediments in the Whittier area. The Pliocene and Miocene marine sediments below the San Pedro Formation generally contain saline water in the Whittier area, although locally can contain fresh water. These units are considered non-water-bearing where exposed in the Puente Hills and include the Pliocene Pico and Repetto Formations and the Upper Miocene Puente Formation.

The major geologic structures in the area include a homocline that underlies the La Habra piedmont slope, the northwest-trending La Habra syncline underlying the alluvial basin, and the west-northwest trending Santa Fe Springs anticline situated below the slightly uplifted Santa Fe Springs plain. The La Habra syncline affects the San Pedro Formation and, to a lesser extent, the Lakewood Formation, and has a surface expression as the axis of the basin. The Santa Fe Springs anticline folds both the San Pedro and Lakewood Formations; shallow aquifers thin across the crest of the anticline. The west-northwest trending Whittier fault is located northeast of the site in the Puente Hills (CDWR, 1961).

As reported by CDWR (1961), the uppermost unit in the vicinity of the Omega site consists of the "Bellflower Aquiclude." The Bellflower Aquiclude comprises all the fine-grained sediments that extend from the ground surface down to the first aquifer. The Bellflower Aquiclude consists primarily of clay and sandy clay to silt, and ranges from 20 to more than 40 feet in thickness in this area. CDWR (1961) considers the Bellflower Aquiclude to be present in both the recent alluvium and the upper part of the Lakewood Formation. In the Whittier area, the Bellflower Aquiclude is considered to be entirely within the Lakewood Formation. Water-bearing zones locally occurring within the Bellflower Aquiclude are referred to collectively and informally as the Semi-perched Aquifer.

The Lakewood Formation consists of non-marine deposits of Late Pleistocene age and attains a maximum thickness of 70 feet. The Gage Aquifer is the major water-bearing member and comprises the basal lithologic unit of the Lakewood Formation. It consists of about 30 feet of sand with some interbedded clay. Based on previous investigations at the Omega site, the Gage Aquifer appears to be absent beneath the site proper. A sand interval found in exploratory borings a short distance southwest of the site is believed to correlate with the Gage Aquifer (England and Hargis, 1996). The Gage Aquifer is interpreted by CDWR (1961) to extend eastward approximately 2.5 miles south of the site. However, exploratory borings suggest the Gage is present west of the Omega site, but pinches out or disappears toward the east. The Gage Aquifer does not appear to be an important source of drinking water in the Whittier area, based on elevated total dissolved solids (TDS) concentrations observed during sampling, and none of the local water supply wells produce water from this aquifer.

Underlying the Lakewood Formation are primarily marine sand and gravels with interbedded clay, assigned to the San Pedro Formation. The San Pedro Formation reaches a maximum thickness of 850 feet and extends to a depth of about 920 feet. The San Pedro Formation unconformably underlies the Lakewood Formation. The San Pedro Formation has been subdivided into five named aquifers separated by clay members. A fine-grained layer is also typically present at the top of the sequence, although in localized areas, the uppermost San Pedro Formation aquifer may be merged with the overlying aquifer, and one or more of the five aquifers may also be merged (CDWR, 1961). This suggests that the Gage sand unit could directly overlie, and be in hydraulic connection with, San Pedro Formation aquifers in the vicinity of the Omega site. Subsurface explorations conducted near the site to date, however, have identified clays underlying the suspected Gage-equivalent sand unit.

The five aquifers defined within the San Pedro Formation include, from top to bottom, the Hollydale, Jefferson, Lynwood, Silverado, and Sunnyside. The upper two aquifers are less extensive and appear to be absent in the immediate vicinity of the Omega site.

The San Pedro aquifers consist of varying amounts of sand and gravel with some interbedded clay. The thickness of the aquifers increases with depth. The shallow Hollydale Aquifer ranges from 10 to 25 feet, whereas the deepest Sunnyside Aquifer ranges from 200 to 300 feet. The base of the Sunnyside Aquifer reaches a maximum depth of about 1,000 feet bgs (CDWR, 1961). The San Pedro Formation aquifers are the primary source of water for the production wells in the area.

The Pliocene and Miocene sediments below the San Pedro Formation generally contain saline water in the area, but locally contain freshwater (CDWR, 1961).

Based on a records search by England-Hargis (1996), there are six water supply wells within 1.5 miles of the site. The nearest well, 02S/11W30-R3, also known as Santa Fe Springs Well No. 1 (SFS#1), is located 1.3 miles to the west-southwest of the former Omega Facility, at the Santa Fe Springs Fire Station on Dice Road near Burke Street. The well is screened from 200 to 288 feet bgs and 300 to 900 feet bgs. Aquifers that are tapped by SFS#1 are believed to include the Silverado and Sunnyside Aquifers, which occur within the lower part of the Lower Pleistocene San Pedro Formation. In several years of monitoring SFS#1, low concentrations of chlorinated hydrocarbons (including TCE, chloroform, and PCE) have occasionally been detected. Most recently (in February 2003), only TCE at a concentration of 0.64 microgram per liter ($\mu\text{g/L}$) was reported above the detection limit. Hexavalent chromium was reported at a concentration of 2.6 $\mu\text{g/L}$. The depth interval(s) from which the contamination is entering the well has not been established. The production rate of SFS#1 ranges up to approximately 1,250 gallons per minute (gpm) (England and Hargis, 1996). It is not established what effect well SFS#1 has on local groundwater flow direction and contaminant migration; shallow groundwater in the vicinity of the well appears to flow toward the south, unaffected by pumping from SFS#1 (Weston, 2003).

The Los Nietos water supply well (02S/11W30-Q5) is located about 1.5 miles southwest of the site (about 1,500 feet west-northwest of SFS#1). This well is screened from 152 to 370 feet bgs. PCE and TCE were detected at unknown concentrations in 1986-90 (Weston, 2003). The well locations are shown on Figure 3-1, in Section 3.

The remaining wells (2S/11W-29E5, 2s/11W-32G3, 2S/11W-33M1, and 2S/11W-32J4) are no longer operating, are used for irrigation, no water-quality data were available, or their exact locations are unknown (Weston, 2003).

2.3.2 Site Hydrogeology

The hydrogeology of the Omega site has been explored with borings and Cone Penetrometer Testing (CPT). The former Omega Chemical site is underlain by relatively low permeability silty and clayey soils to a depth of about 120 feet bgs. A sand unit, which may correlate with the Gage Aquifer, has been encountered approximately 600 feet southwest of the site beneath Putnam Street. Groundwater at OU-1 generally occurs at a depth of approximately 70 feet bgs. The depth to groundwater ranges between 40 and 70 feet over OU-2. Locally, groundwater flow appears to be generally to the southwest. Camp Dresser and McKee (CDM, 1999) reported a local direction of groundwater flow toward the southwest with a hydraulic gradient of 0.009 foot per foot (ft/ft). TDS concentrations of greater than 3,000 milligrams per liter (mg/L) were reported in shallowest groundwater samples collected by CDM (1999).

The hydraulic conductivity of the upper silty unit was estimated from step-drawdown tests conducted in Monitoring Well OW2 and a slug test at Monitoring Well OW1. The hydraulic conductivity in this area was found to range from 0.8 to 1.6 feet per day (CDM, 2003). The hydraulic conductivity of the more permeable units southwest of Omega is not known.

2.4 Nature and Extent of Contamination

2.4.1 Nature of Contamination

Groundwater at the Omega site has been impacted primarily by chlorinated hydrocarbons and Freon compounds (i.e., volatile organic compounds [VOCs]). The following summary is based on the results of the Phase 2 Groundwater Characterization Study conducted by Weston Solutions, Inc. (2003).

The five primary chlorinated compounds detected in groundwater are:

- Perchloroethene/Tetrachloroethene (PCE)
- Trichloroethene (TCE)
- 1,1-dichloroethene (1,1-DCE)
- cis-1,2-dichloroethene (cis-1,2-DCE)
- Chloroform

These are the most widespread VOCs detected in groundwater in the vicinity of the Omega site.

Eight other VOCs were locally detected in groundwater in lower concentrations. These compounds include:

- 1,2-dichloroethane (1,2-DCA)
- 1,1-dichloroethane (1,1-DCA)
- 1,1,1-trichloroethane (1,1,1-TCA)
- trans-1,2-dichloroethene (trans-1,2-DCE)
- 1,2-dichloropropane
- Vinyl chloride
- Methylene chloride
- Carbon tetrachloride

Freon compounds reportedly detected at the site include:

- Trichlorofluoromethane (Freon 11)
- 1,1,2-trichloro-1,2,2-trifluoroethane, commonly referred to as trichlorotrifluoroethane (Freon 113)

As part of Weston's investigation, groundwater samples from monitoring wells were also analyzed for metals, as well as some indicators of the potential for occurrence of natural attenuation processes including total organic carbon (TOC), total Kjeldahl nitrogen (TKN), sulfate, sulfide, and methane/ethane/ethene. Of these analytes, total chromium was the most significant with respect to groundwater impacts originating from the Omega site versus other potential contamination sources. At some monitoring wells, chromium concentrations approached or exceeded the maximum contaminant level (MCL) of 50 µg/L for drinking water (Weston, 2003).

CDM (1999, 2003b) also reported low detections of aromatic hydrocarbons (toluene, acetone, xylenes, ethylbenzene, and benzene) in samples from shallow wells at the former Omega Chemical Facility. However, toluene and acetone concentrations of up to 900 µg/L and

6,300 µg/L, respectively, have been detected in samples from Well OW8 located downgradient of the Omega site. These compounds appear to be from a different downgradient source (CDM, 2003b).

2.4.2 Extent of Contamination

Figures 2-2 through 2-5 present chemical distribution maps for PCE, TCE, Freon 11, and Freon 113 in groundwater, respectively. Maps for these particular analytes are presented because of their widespread distribution and reportedly higher concentrations offsite of Omega. The maps contain data from Phase 1 and Phase 2 investigations conducted by Weston Solutions, Inc. The data points include results from push-probe sampling (PP), soil borings (B), EPA monitoring wells (MW), and OPOG monitoring wells (OW). The contours are presented as drawn by Weston (2003) without modification.

As shown on Figure 2-2, the PCE plume extends at least 2.2 miles downgradient west-southwest of the Omega site, with a width approaching 3/4 mile. The maximum PCE concentration observed at the site was in groundwater from soil boring B109 (53,000 µg/L), which is located less than 500 feet west of Omega. High PCE concentrations were also reported at other borings in the immediate area (B108 and B110). The PCE concentrations at B108 and B110 were 5,100 µg/L and 8,000 µg/L, respectively. Concentrations above 1,000 mg/L comprise about 5 percent of the area of the PCE plume, occurring primarily within approximately 2/3-mile downgradient of the Omega site. Most of the PCE plume is characterized by concentrations in the range of 10 to 100 µg/L. An isolated area of relatively high concentrations of PCE was reported at PP058 and PP066 (3,300 µg/L and 850 µg/L, respectively), indicating the likely presence of a separate source area in this region. Because the majority of the monitoring points that have been used to define the VOC plumes are based on in situ groundwater samples from CPT soundings, which sample only a very small depth interval, it is possible that some of the lateral variation in concentrations is a result of the limitations of this sampling technique.

The TCE plume (Figure 2-3) is similar in extent to the PCE plume, but is narrower and exhibits lower concentrations overall. The majority of the TCE plume comprises concentrations between 10 and 100 µg/L, but concentrations exceeding 100 µg/L appear to be more continuous (if less extensive) than for the PCE plume. The highest concentration parts of the TCE plume (greater than 1,000 µg/L) occur in apparently unconnected zones near the Omega site. The narrower and smaller occurrence is nearly coincident with the estimated extent of 10,000 µg/L PCE concentrations immediately downgradient from the Omega site. The other area of 1,000 µg/L TCE begins with a concentration of 7,000 µg/L at its northeastern end (B103) and continues west-southwest for approximately 3,000 feet. Unlike PCE, elevated TCE concentrations occur northwest of the Omega site in concentrations ranging from approximately 200 to 960 µg/L.

The Freon 11 plume (Figure 2-4) and Freon 113 plume (Figure 2-5) are approximately one-half to two-thirds the width of the PCE and TCE plumes; however, the downgradient extent is approximately 90 percent that of the TCE and PCE plumes. The plumes are well defined by groundwater samples with detected concentrations less than 2 µg/L to the north, west, and south sides. Aside from the smaller downgradient extent and lower concentrations of the Freons (800 µg/L maximum for Freon 11 and 2,400 µg/L for Freon 113),

the distribution of the Freons is similar to that of PCE and TCE. The southwestern end of the Freon 113 plume encompasses the isolated area of elevated (greater than 1,000 µg/L) PCE concentrations some 8,000 feet from the Omega site. The Freon 11 plume also extends to this area. The Freon concentration contours are drawn (Weston, 2003) as discontinuous (Figure 2-5); however, the data may also be interpreted as one continuous plume similar to the Freon 113 plume.

Data indicative of the vertical distribution of contamination include groundwater samples from co-located monitoring wells screened at different depths and co-located direct-push samples collected at different depths. In most cases, contaminant concentrations were much lower at deeper intervals, particularly where intervening fine-grained units restricted downward migration (Weston, 2003). Almost all groundwater samples were collected from depths less than 100 feet bgs, or about 30 to 60 feet below the water table. It is anticipated that within the known extent of the VOC plume, significant contaminant concentrations in groundwater are limited to the shallow zone of approximately 30 to 60 feet below the water table. Locally, however, the contamination may be present in deeper, highly permeable units that serve as preferential groundwater flow pathways. Also, further downgradient the contamination is expected to migrate deeper as a result of areal recharge to the aquifer.

2.4.3 Contaminant Migration

The contaminant migration rate was considered for the proposed well placement at the downgradient (leading) edge of the plume. The site history and estimated extent of the contamination in groundwater provide an indication of the plume migration rate. The Omega site started operations in 1976. The contamination has apparently migrated almost 13,000 feet southwest from the Omega site over 26 years (between 1976 and 2002 field investigations; Weston, 2003). Assuming that a contaminant release occurred in the first year of operation, the average contaminant migration rate is 500 feet per year. This apparent migration rate estimate assumes the longest known timeframe over which the contamination could travel in groundwater from the Omega site. However, it is also possible that the contamination found in portions of the downgradient area of the plume originated entirely from sources other than the Omega site. In such a case, the contaminant migration could be slower.

The estimated rate of 500 feet per year can be considered the upper limit. Considering a groundwater gradient across the entire OU-2 (0.0032 ft/ft) and an effective porosity of 14.3 percent (Weston, 2003), this migration rate would correspond to an "effective" or average hydraulic conductivity at OU-2 of 60 feet per day. Such a hydraulic conductivity value can be expected for shallow unconsolidated sands. Therefore, the migration rate of 500 feet per year may be a realistic migration rate of contamination from the Omega site.

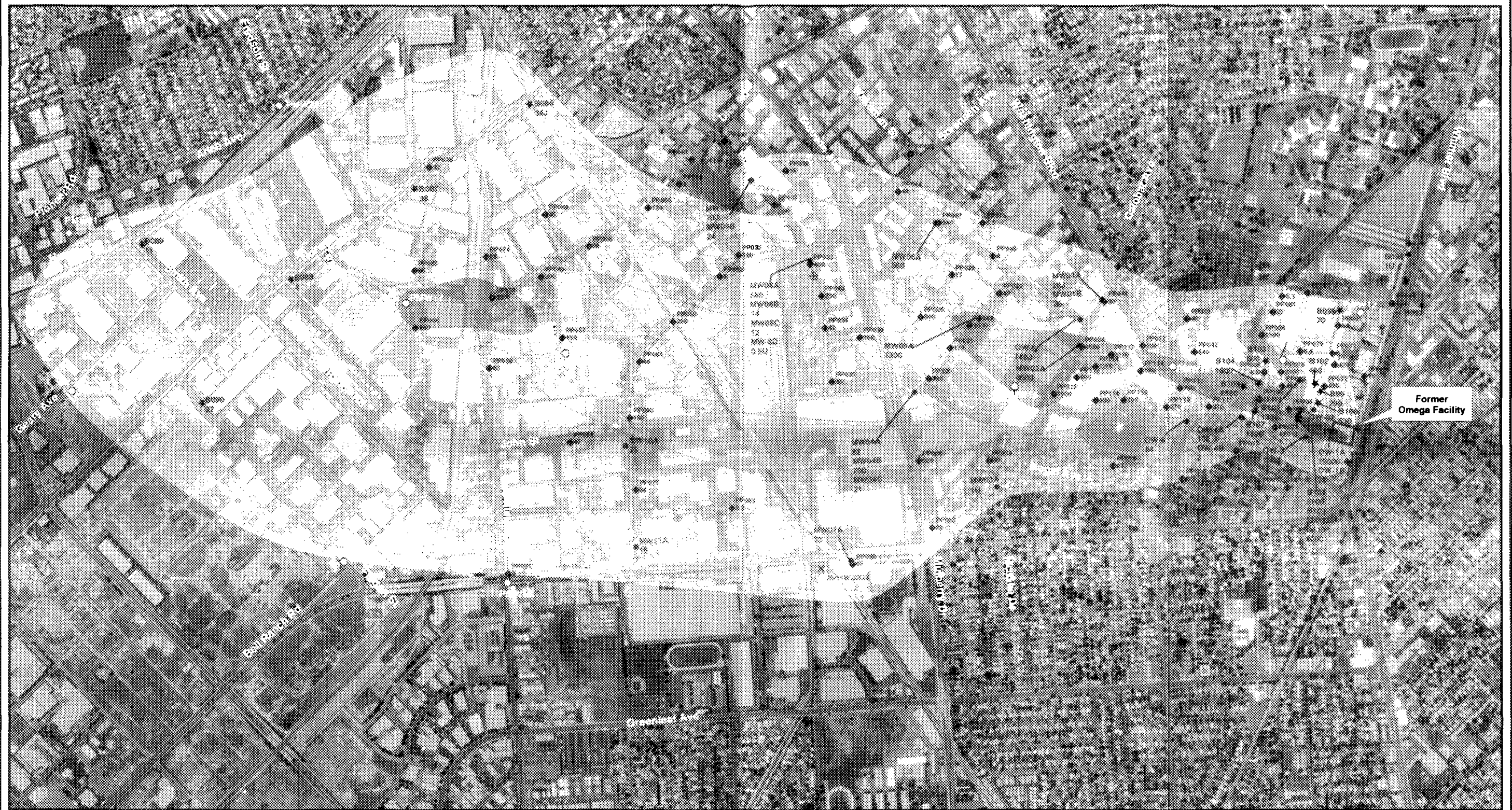
The elevated VOC concentrations in the general vicinity of the intersection of Dice Road and Los Nietos Road (Figures 2-2 to 2-5) may have originated from sources other than the Omega site. Groundwater contours for February-March 2003 (Figure 2-6) and for May-June 2003 (Figure 2-7) indicate that this area is downgradient of several industrial facilities with known groundwater contamination (such as McKesson Corporation and Angeles Chemical). Production well SFS#1 is located north of the anticipated flow path from the Omega site, indicating that the well may have been impacted by contamination from other sites.

System	Series	Formation		Aquifer and Aquiclude	Thickness (feet)
QUATERNARY	RECENT	ALLUVIUM		BELLFLOWER AQUICLUDE	10-40
				GASPUR	0-30
	UPPER PLEISTOCENE	LAKEWOOD FORMATION		BELLFLOWER AQUICLUDE	10-40
				ARTESIA	0-40
				GAGE	0-30
				HOLLYDALE	0-40
	LOWER PLEISTOCENE	SAN PEDRO FORMATION		JEFFERSON	20-40
				LYNWOOD	50-100
				SILVERADO	100-300
				SUNNYSIDE	200-300
				LOCAL	
TERTIARY	UPPER PLIOCENE	PICO FORMATION		UNDIFFERENTIATED	
				UNCONFORMITY	

Figure 2-1
Generalized Stratigraphic Column for the
Whittier Area (Based on data from CDWR, 1961)
Omega Chemical Superfund Site
Whittier, California

Source: Weston, 2003.

CH2MHILL



Legend

Wells

- × Production Well
- Monitoring Well

MW08A = Station Name
580 = Concentration Value

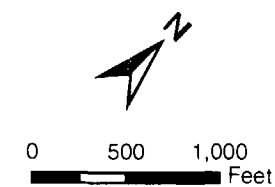
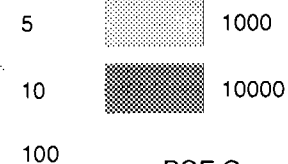
Hydropunch

- ◆ CPT Boring
- ★ Auger Boring

PP062 = Station Name
250 = Concentration Value



PCE Concentration (ug/L)



PCE Concentrations Contours from Weston, 2003

Figure 2-2
PCE Concentrations
in Groundwater
Omega Chemical, Inc



Date: 02/03/2004



Legend

Wells

- × Production Well
- Monitoring Well

MW08A = Station Name
120 = Concentration Value

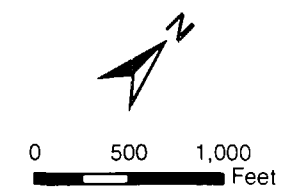
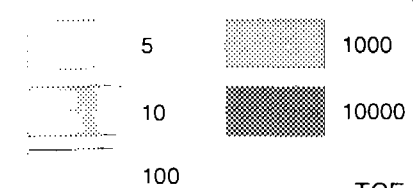
Hydropunch

- ◆ CPT Boring
- ★ Auger Boring

PP062 = Station Name
25 = Concentration Value



TCE Concentration (ug/L)



TCE Concentrations Contours from Weston, 2003

Figure 2-3
TCE Concentrations
in Groundwater

Omega Chemical, Inc



Date: 02/03/2004



Legend

Wells

- × Production Well
- Monitoring Well
- MW08A = Station Name
- .5U = Concentration Value

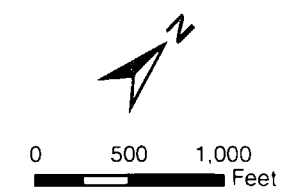
Hydropunch

- ◆ CPT Boring
- ★ Auger Boring
- PP062 = Station Name
- 0.5 = Concentration Value



FREON 11 Concentration (ug/L)

- | | |
|-----|-------|
| 5 | 1000 |
| 10 | 10000 |
| 100 | |



FREON 11 Concentrations Contours from Weston, 2003

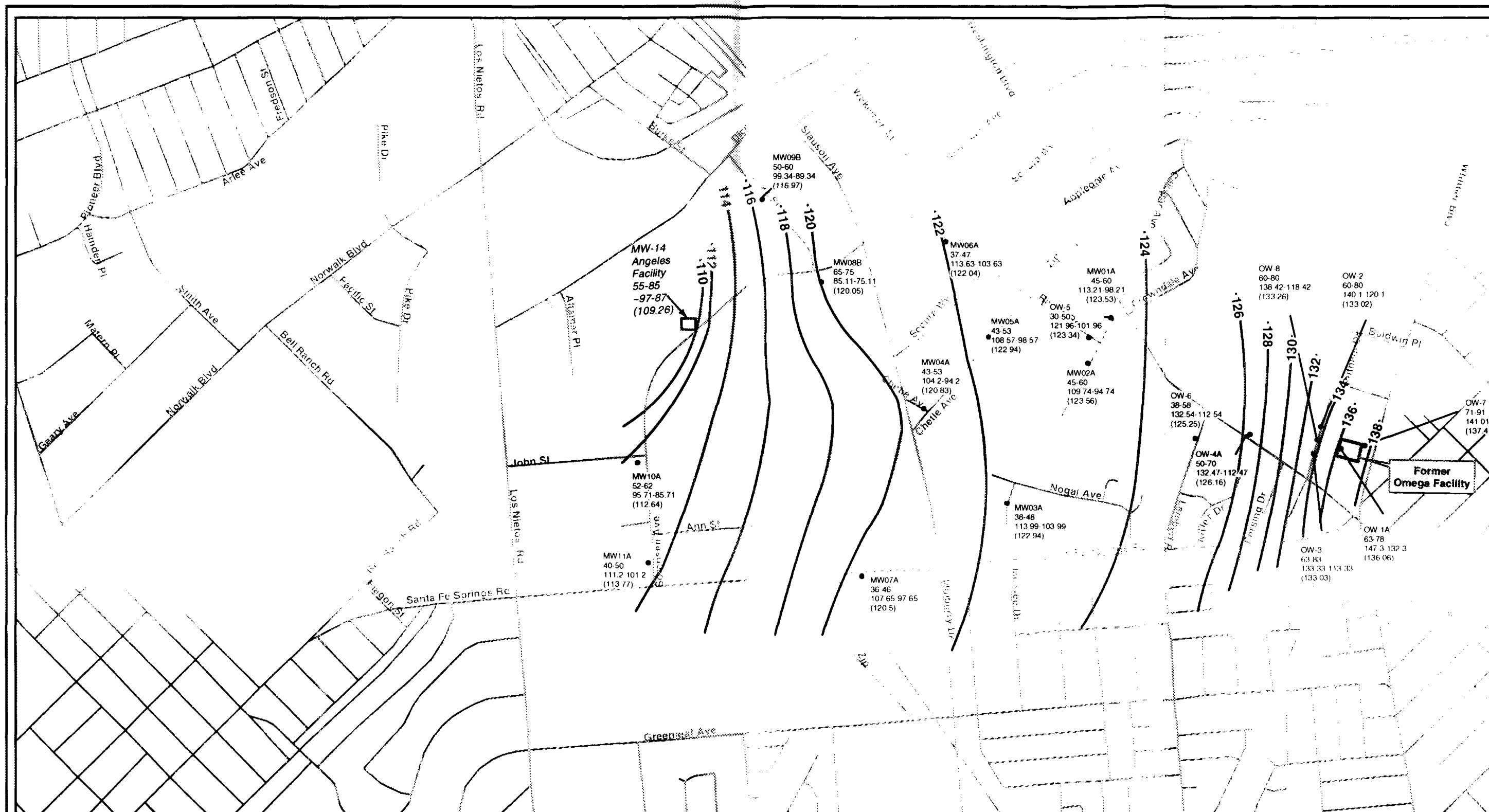
Figure 2-4
FREON 11 Concentrations
in Groundwater
Omega Chemical, Inc



Date: 02/03/2004



Legend Wells X Production Well * Proposed Extraction Well • Monitoring Well ○ Proposed Monitoring Well		Hydropunch ◆ CPT Boring ★ Auger Boring PP062 = Station Name 0.5 = Concentration Value	<div style="border: 1px solid black; width: 20px; height: 10px; display: inline-block;"></div> Former Omega Facility	FREON 113 Concentration (ug/L) <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 10px; height: 10px; margin-right: 5px;"></div> 5 <div style="border: 1px solid black; width: 10px; height: 10px; margin-left: 20px; background-color: #cccccc;"></div> 1000 <div style="border: 1px solid black; width: 10px; height: 10px; margin-left: 20px; background-color: #808080;"></div> 10000 </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 10px; height: 10px; margin-right: 5px;"></div> 10 <div style="border: 1px solid black; width: 10px; height: 10px; margin-left: 20px; background-color: #404040;"></div> 10000 </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 10px; height: 10px; margin-right: 5px;"></div> 100 </div>	<div style="text-align: center;"> 0 500 1,000 Feet </div>	<p align="center">Figure 2-5 FREON 113 Concentrations in Groundwater Omega Chemical, Inc</p>
FREON 113 Concentrations Contours from Weston, 2003					Date: 02/03/2004	



Legend

- Monitoring Well
- MW10A = Station Name
- 52-62 = Screen Depth
- 95.71-85.71 = Screen Elevation
- (112.64) = Groundwater Elevation
- Former Omega Facility

Notes: 1. Groundwater elevation at the Angeles Facility MW-14 measured on February 27, 2003.
2. OPOG and OU-2 groundwater elevations measured between February 19 and March 3, 2003.

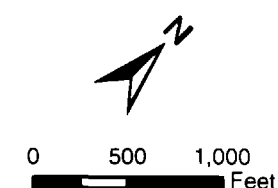
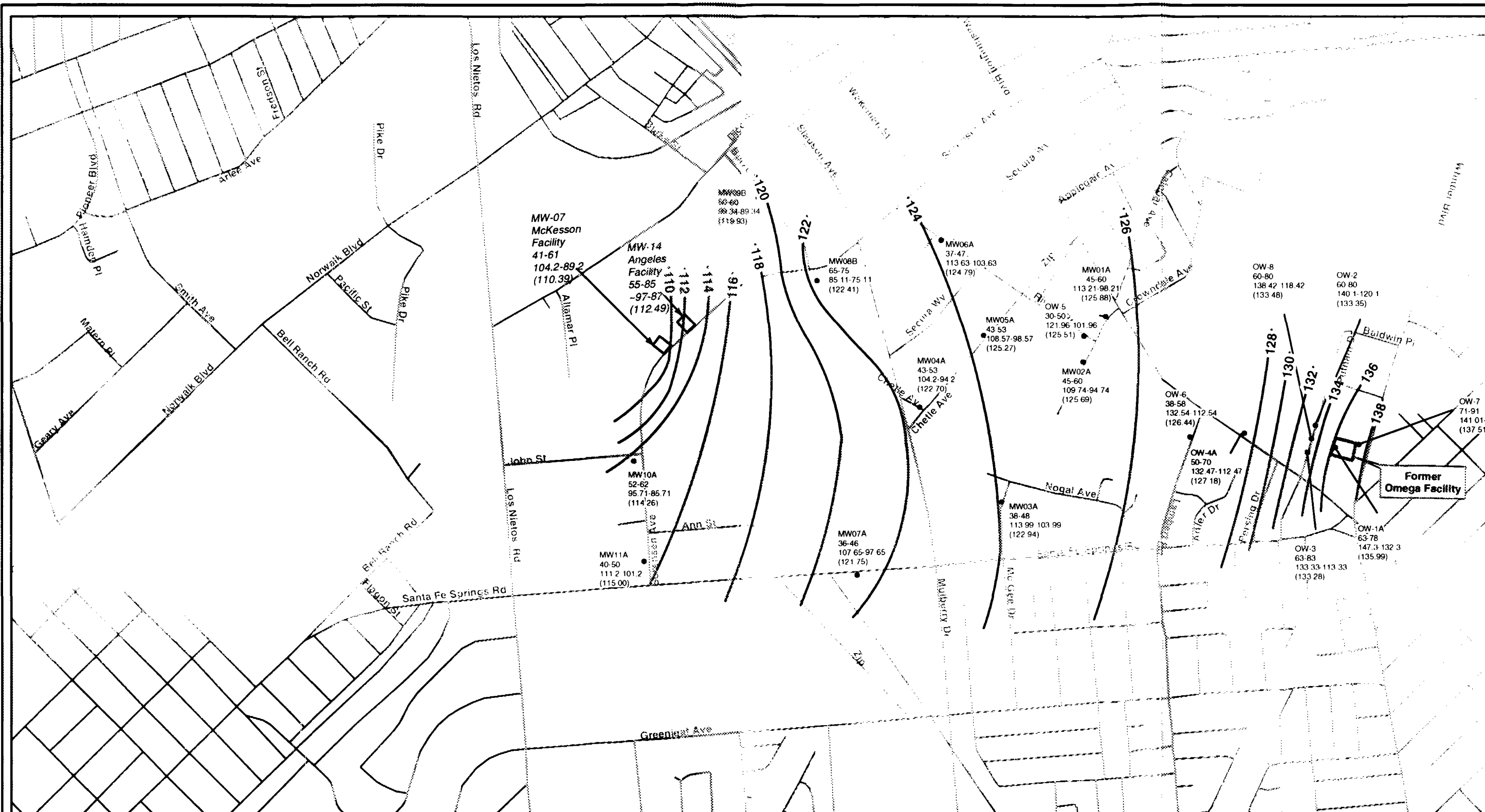


Figure 2-6
Groundwater Contours
February - March 2003

Omega Chemical, Inc



Date: 04/20/2004



Legend

- Monitoring Well
- MW10A = Station Name
- 52-62 = Screen Depth
- 95.71-85.71 = Screen Elevation
- (114.26) = Groundwater Elevation
- Former Omega Facility

Notes: 1. Groundwater elevation at the Angeles Facility MW-14 measured on May 19, 2003.
 2. Groundwater elevation at the McKesson Facility MW-07 measured on June 9, 2003.
 3. OPOG and OU-2 groundwater elevations measured between May 13 and May 21, 2003.

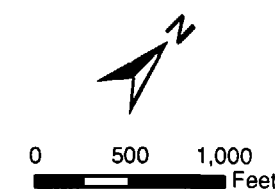


Figure 2-7
Groundwater Contours
May - June 2003

Omega Chemical, Inc



Date: 04/20/2004

SECTION 3

Rationale for Sample Locations, Number of Samples, and Laboratory Analyses

This section presents the overall rationale for the sampling and analysis associated with this RI/FS. A description of the sample locations, number of samples, and laboratory analyses to be performed on those samples also is provided. The number and location of samples collected may vary depending on changes in the scope of work.

As discussed in Section 1, and in the data quality objectives (DQOs) included in the accompanying Quality Assurance Project Plan (QAPP), the sampling activities will address the following:

- Installation of additional groundwater monitoring wells to (1) further assess the nature and extent of groundwater contamination; (2) provide additional information regarding the subsurface geology and contaminant transport; (3) provide locations for measurement of water levels to assess groundwater flow directions; and (4) provide permanent monitoring locations that can be used to assess changes in contaminant concentration over time.
- Aquifer testing and slug testing of new wells to estimate hydraulic properties of the shallow zone aquifer beneath and downgradient of the site.
- Sampling of investigation-derived waste (IDW), including drill cuttings, well development water, well purge water, and potentially drilling mud, to determine the appropriate disposal option.
- Groundwater sampling to assist in identifying additional potential sources of groundwater contamination.
- Baseline groundwater sampling to determine the presence of emergent groundwater contaminants (1,4-dioxane, perchlorate, NDMA, hexavalent chromium, and 1,2,3-trichloropropane [1,2,3-TCP]).
- Groundwater sampling and analysis of parameters for evaluation of groundwater treatment options and options for discharge of treated groundwater.
- Ongoing groundwater sampling and water level monitoring to identify changes in contaminant extent and concentration and groundwater flow direction.

3.1 Well Installation

During the remedial investigation, 11 monitoring wells or clusters and one extraction well will be installed to further characterize the nature and extent of contamination and to characterize the site hydrogeology. The new groundwater wells will be installed to:

- Further characterize the vertical and lateral extent of contaminant distribution in groundwater within the OU-2 study area, and better define the contaminant distribution within the plume.
- Investigate the potential presence of emerging contaminants.
- Further define aquifer lithology and estimate aquifer hydraulic properties from aquifer tests and slug tests.
- Better define groundwater flow direction in the downgradient portion of the plume.
- Assess vertical flow gradients and provide permanent monitoring points for measuring groundwater elevations.
- Provide permanent monitoring points for tracking contamination in the downgradient plume area and contaminant distribution within the plume. Groundwater monitoring wells will be sampled quarterly for 2 years to evaluate long-term concentration trends and to generate sufficient data to accurately assess representative concentrations.

3.1.1 Well Location Rationale

Eleven monitoring wells or well clusters (PMW12 to PMW22) and one extraction well (PEW1) are proposed for construction in the OU-2 study area. The rationale for the proposed well placement and their location is summarized in Table 3-1. Figure 3-1 shows the locations of the proposed wells and screen depths, as well as the locations of existing EPA and OPOG monitoring wells. The proposed wells are also shown on the PCE, TCE, Freon 11, and Freon 113 plume maps (Figures 2-2 through 2-5). The proposed well names start with "PMW" and continue with a sequential number (e.g., PMW15). They are numbered sequentially from east to west, not in the order in which they will be installed (the installation of some of the wells will be postponed, as discussed below). Once installed, the wells will be numbered in a sequence with the existing wells in the order of installation (i.e., starting with MW12).

A combination of single-screen monitoring wells and well clusters, is proposed. Well clusters will allow monitoring of heads and contaminant concentrations at different depth zones. In the downgradient area of the plume, well clusters are also more likely to intercept contamination that may have spread over a greater extent and depth in the aquifer compared to locations closer to the source. The well clusters will be installed as multi-completion wells within one or two borings. Two three-well clusters are proposed.

Single-screen wells will be installed at the remaining locations. The well screen intervals will be selected based on the results of discrete-depth groundwater sampling during drilling; the depth interval with the highest contaminant concentration will be screened. If discrete-depth sampling results indicate that groundwater contamination extends over more than one permeable unit, a well cluster will be installed at that location instead of a single well.

As shown on Figure 2-2, proposed monitoring well clusters PMW17 and PMW20 are situated along the suspected axis of the PCE contaminant plume in the downgradient area. Well PMW17 is proposed downgradient of a high-concentration area exceeding 1,000 µg/L that is located approximately 8,000 feet downgradient of the Omega site and approximately two-thirds of the distance to the leading edge of the plume. A cluster of two to three wells is

proposed here instead of a single well to allow monitoring of heads (to assess vertical flow gradients) and contaminant concentrations in groundwater at different depths. Well PMW20 is situated close to the anticipated leading edge of the plume. A cluster of wells, instead of a single well, is proposed at this location because the depth interval of the contaminated aquifer is expected to increase with distance from the source area(s). A well cluster will allow for monitoring of contaminant concentrations and heads at different depths. A well cluster is also more likely to intercept contamination that may migrate to this location at a later time than a single well.

TABLE 3-1
Location and Rationale for Groundwater Monitoring Wells

Well Name	Location	Rationale
PEW-1	About 30 feet from MW08 well cluster	Pumping well for an aquifer test within an apparent zone of preferential contaminant migration. Screened approximately between 60 and 80 feet bgs to target the same depth zone as MW08B.
PMW12	On Baldwin St., 500 feet west of Whittier Blvd.	Provide information on contaminant distribution in an area that may have been impacted by a source other than Omega.
PMW13	About 500 feet east-southeast from the intersection of Putnam St. and Pacific St.	Provide information on contaminant distribution that likely originated from a source other than Omega.
PMW14	On Washington Blvd., about 250 feet west of intersection with Lambert Rd.	Provide data in a high-concentration area of the plume to verify the plume continuity and vertical contaminant distribution, and to characterize the lithology down-gradient of the Omega site.
PMW15	Southwest of the south end of Calopar Ave.	Verify the plume continuity in an area that contains elevated VOC concentrations downgradient of the Omega site.
PMW16	Between Dice Rd. and Sorenson Ave., about 2,000 feet south of Burke St.	Characterize the distribution of contamination within the plume. Well is located upgradient of a potential separate VOC source other than Omega.
PMW17	At the intersection of Pike Dr. and Pacific St.	3-well cluster to characterize and monitor vertical extent of contamination at a location downgradient of a high concentration area away from the Omega site, and provide lithologic and head data.
PMW18	At the intersection of Santa Fe Springs Rd. and Los Nietos Rd.	Characterize leading edge of the contaminant plume.
PMW19	At intersection of Bell Ranch Rd. and Flagon St.	Characterize leading edge of the contaminant plume.
PMW20	On Geary Ave., 500 feet south of intersection with Matern St.	Three well cluster to characterize vertical extent of contamination, and provide lithologic and head data.
PMW21	On Hamder St., 250 feet east of Pioneer Blvd.	Characterize leading edge of the contaminant plume.
PMW22	At intersection of Arlee Ave. and Fredson St., 1,500 feet west of intersection of Norwalk Blvd. and Pike Dr.	Characterize leading edge of the contaminant plume.
PMW23, PMW24, PMW25	Downgradient of PMW18, PMW19, PMW20, PMW21, PMW22	Characterize leading edge of the contaminant plume if necessary (e.g., if contamination above MCLs is detected in samples from wells PMW18, PMW19, PMW20, PMW21, PMW22).

Proposed monitoring wells PMW18, PMW19, PMW21, and PMW22 are situated near the suspected leading edge of the contaminant plume and will assist in characterizing the lateral extent of contamination downgradient of the Omega Site. Installation of these wells will also provide additional information on groundwater elevations and aquifer lithology. These wells are proposed in areas of expected low concentrations. The proposed well locations may be modified based on the results of the investigation (cluster wells PMW17 and PMW20 will be installed before the leading-edge wells). The downgradient extent of the contamination as shown on Figures 2-2 to 2-5 is unknown because no data are available from the downgradient area. Preferably, the new downgradient wells would be installed in a zone where contaminant concentrations range between non-detects (NDs) and MCLs to characterize the plume leading edge. If contaminant concentrations detected in groundwater samples from wells PMW18, PMW19, PMW21, and PMW22 exceed MCLs, approximately three additional wells will need to be installed farther downgradient.

Well PMW16 is situated along the axis of the plume, upgradient of the greater than 1,000 µg/L hot spot located in the vicinity of Los Nietos Road and Pacific Street, where potential sources of contamination other than the Omega site may be present. This well will be installed to characterize the distribution of contamination within the plume. There is an apparent low-concentration zone at this location (Figure 2-2 PCE), and a high-concentration zone just downgradient, as characterized by a former direct-push investigation. This well will verify the continuity of the plume. The installation of this well will be postponed until after an investigation of the source areas.

Well PMW15 is situated in an apparent high-concentration area approximately 3,000 feet downgradient of the Omega site and will verify the plume continuity. The installation of this well will be postponed until after an investigation of the source areas.

Well PMW14 is proposed in a high-concentration area of the plume, approximately 1,700 feet downgradient of the Omega site, to verify the plume continuity, vertical contaminant distribution, and to characterize the lithology downgradient of the Omega site.

Well PMW12 is proposed approximately 1,100 feet north-northwest of the Omega site in an area of contamination that likely originated from another source. The installation of this well will be postponed until after an investigation of the source areas.

Well PMW13 is proposed approximately 800 feet west-northwest of the Omega site in an area of contamination that may have originated from the Omega site and/or another source. This well will provide information on the aquifer lithology as well as contaminant distribution. The installation of this well will be postponed until after an investigation of the source areas. The contaminant concentration distribution in this area is uncertain; it is largely known from direct-push sampling only. Another well may need to be installed in this area.

Extraction well PEW-1 is proposed to be constructed just south of the existing MW8 well cluster. The extraction well will serve as a pumping well for an aquifer test that will be conducted to estimate aquifer hydraulic properties in this area. This location was selected because it is downgradient of a zone of high contaminant concentrations and is interpreted to be within a highly permeable, laterally extensive zone that provides a preferential contaminant transport pathway from the Omega site. The contaminant concentrations

detected in samples from the MW8 well cluster decreased with depth (PCE and TCE concentrations of 580 and 120 µg/L in the top screen interval MW08A decreased to 14 and 3 µg/L in MW08B, respectively), indicating that the top screen interval intercepts the main contaminant transport pathway (Weston, 2003). The test will assess the hydraulic communication between the contaminated shallow and relatively clean deeper aquifer zones and will provide estimates of hydraulic properties of the shallow zone aquifer. The deeper screens of Well MW08 are believed to have intercepted regional aquifers (starting with Gage and Hollydale Aquifers from the top) that can potentially become major contaminant transport pathways (Weston, 2003). Pumping from the less contaminated zone will also allow onsite treatment of the extracted groundwater.

The new wells will be installed in two phases. Wells PMW14, PMW17, PMW18, PMW19, PMW20, PMW21, and PMW22 will be installed first to characterize the extent of the contamination, aquifer lithology, and groundwater flow patterns. The installation of wells PMW12, PMW13, PMW15, and PMW16 will be postponed to consider the results of the first phase and also the results of the investigation of the potential source areas other than the former Omega Chemical Corporation site. The proposed locations for the second-phase wells are tentative and will likely be revised based on the new information. Additional wells for characterizing the plume leading edge will be installed during the second phase of drilling, if necessary.

3.1.2 Depth-Discrete Groundwater Samples

Discrete-depth, screening-level groundwater samples will be collected from the boreholes for the monitoring wells in order to select a screen-depth interval within the contaminated zone. The samples will be taken through the drive-casing using a disposable bailer. The first sample will be taken immediately below the water table.

If a thick coarse-grained (sandy) aquifer unit is encountered, the following samples will be collected every 10 feet for a total of five samples. If alternating layers of saturated coarse and fine-grained (silts and clays) sediments are intercepted by the borehole, groundwater samples will be taken from the coarse-grained units. The total number of samples taken may be adjusted according to encountered lithologic conditions and laboratory results. If contamination above MCL is detected in the lowest sample, drilling will continue to a greater depth and additional samples will be taken. If the contaminated zone with concentrations above MCL spans more than 30 feet within one permeable unit, the length of the well screen will be increased (in 5-foot increments, based on the thickness of the contaminated zone) from the proposed 10 feet. If contamination above MCLs is found in two or more permeable zones separated by low-permeability units, a multiple-completion well or a well cluster will be installed.

A 24-hour or shorter turnaround time will be required for the samples to allow for timely decisions regarding well construction. An onsite, mobile laboratory, such as EPA's Field Analytical Support Program Laboratory, will be required to accommodate the short turnaround time and to handle potential additional samples. It is anticipated that the borehole for each well will be drilled in 1 to 2 days and the analytical results will be needed the following day. The drill rig will remain at the site until the analytical results are available for the decision on the screen-depth intervals or to continue drilling to a greater depth. The borings will be drilled and wells installed sequentially.

The estimated total number of the discrete samples, without quality control (QC) samples, is 55 samples (5 samples per each borehole).

Field blank samples will be collected to check for possible cross-contamination of groundwater samples from the point of sample collection to analysis of the samples by the laboratory. The number of equipment blanks will be 10 percent of the number of primary samples.

One laboratory QC matrix spike/matrix spike duplicate (MS/MSD) sample will be identified for every 20 primary samples collected. A double volume of sample is collected for each MS/MSD.

3.2 Groundwater Monitoring

All site wells will initially be sampled quarterly to characterize the spatial distribution and temporal trends in water quality. OPOG samples OU-1 wells semiannually. CH2M HILL will sample EPA's wells quarterly and OPOG's wells semiannually.

3.2.1 Sampling Rationale

Analysis of VOCs with low-detection limits will be used to assess the magnitude of groundwater contamination in the new monitoring wells and to determine whether any of the VOCs detected exceed regulatory limits. The rationale for the VOC analyses is that VOCs are the most prevalent contaminants known to have originated from the Omega site.

Sampling for VOCs will be included in all sampling events. Sampling for metals, semi-volatile organic compounds (SVOCs), NDMA, perchlorate, 1,4-dioxane, 1,2,3-TCP, and hexavalent chromium will be conducted to evaluate exceedances of regulatory limits and to assess the need for continued monitoring or future treatment for these analytes. The rationale for these analyses is that many of the compounds have state or federal MCLs, California action levels, or other regulatory limits, and have been detected in areas of OU-2 where VOCs are present. They also require significantly different treatment methods for removal from groundwater compared to VOCs. Remedial action at OU-2 will have to address these compounds in addition to VOCs.

The analysis for emergent chemicals (NDMA, perchlorate, 1,4-dioxane, 1,2,3-TCP, and hexavalent chromium) will be conducted for two consecutive sampling events. Chemicals that are not detected during the two events will not be subsequently analyzed for.

In addition, two rounds of groundwater samples will be analyzed for major ions (calcium, magnesium, potassium, sodium, bicarbonate, chloride, and sulfate), total phosphorus, nitrate and nitrite as nitrogen, ammonia, cyanide, TDS, biological oxygen demand (BOD), chemical oxygen demand (COD), TOC, alkalinity, and pH to evaluate treatment design issues such as granular activated carbon (GAC) usage, mineral precipitation, and potential clogging or bio-fouling problems within a treatment system. All of the preceding sample analyses will be also used to evaluate the treatment discharge options.

3.2.2 Assessment of Regulatory Requirements

The applicable or relevant and appropriate requirements (ARARs) for waters in the State of California have been summarized by California EPA, Regional Water Quality Control Board, Central Valley Region in a compilation of water quality goals published in

August 2003 (Cal-EPA, 2003), and subsequent changes in MCLs, Action Levels, and the Department of Health Services (DHS) list of unregulated chemicals required to be monitored. The ARARs relevant to the development of this FSP have been summarized in Table A-1 (Appendix A). Table A-1 includes drinking water regulatory limits for these constituents such as State of California and federal primary and secondary MCLs, State of California public health goals (PHGs) and action levels (ALs), California Proposition 65 values, and water quality limits established by the California Toxics Rule (CTR), which would be applicable to surface water discharge. Some ARARs (such as the California Ocean Plan requirements, National Salt Water Ambient Water Quality recommendations, and agricultural requirements) are not included in Appendix A as they are not relevant to the conditions at OU-2, or to reclaimed water. The human health standards of the CTR are not applicable, since a court case was recently resolved that determined that CTR criteria are not applicable to surface water reaches with a beneficial use designated as potential municipal.

The compounds listed in Table A-1 include selected constituents regulated for drinking water that are relevant to the Omega site. Future investigations at Omega, namely the planned investigation of potential source areas other than the former Omega Chemical Corporation site, may need to include analyses for other compounds identified as potential contaminants. Based on the results of a records search currently being performed by EPA, the list of analytes will be revised for the source investigation to include the additional compounds.

The *Water Quality Control Plan, Los Angeles Region* (LARWQCB, 1994) (Basin Plan) requires reuse of treated groundwater. The site remedy for groundwater will need to include treatment that meets drinking water standards, because of the potential for the use of treated groundwater for reclaimed water, surface water discharge, and groundwater recharge beneficial use. Depending on the outcome of the FS, the entire suite of analytes required by drinking water regulations may be included in later phases.

Additional standards that apply for the protection of fresh water aquatic life are considered for the FS phase of this investigation because discharge of treated groundwater to storm drains or other conduits will likely be considered. No surface water bodies are present at OU-2. Regulatory requirements applicable to these discharge methods were reviewed to determine which constituents require analysis and the necessary detection limits for each of the analytes or analyses.

The information in Table A-1 was used to determine appropriate analytical methods and required laboratory detection limits to meet the regulatory requirements. Low quantitation limits necessary to confirm compliance with these regulatory requirements may in some cases require the use of a non-contract laboratory program (CLP) laboratory.

3.2.3 Number and Location of Samples

The existing and planned monitoring wells will be sampled quarterly for 2 years. A summary of the location and number of groundwater samples per sampling event, without QC samples, is as follows:

- Proposed EPA monitoring wells PMW12 to PMW22 = 15 samples each quarter
- Existing EPA monitoring wells MW1 to MW11 = 18 samples each quarter

- Existing OPOG monitoring wells OW1 to OW8 = 10 samples semi-annually (to supplement OPOG's semiannual sampling)

A total of 359 groundwater samples, without QC samples, are anticipated for the duration of the 2-year sampling effort.

In addition to groundwater samples, field quality assurance (QA) samples will be collected in the form of duplicates, blanks, and MS/MSD samples. At a minimum, one field duplicate will be collected for each analysis for every 10 wells/screens sampled or one per week, whichever is larger. An attempt will be made to collect duplicate samples from a well that is expected, or known to be, moderately contaminated.

Equipment blank samples will be collected to check for possible cross-contamination of groundwater samples after decontamination of common equipment used to collect samples from a number of different wells or screens in a given day. The number of equipment blanks will be 10 percent of the number of primary samples. One equipment blank will be collected for every 10 field samples (thus, two blanks would be collected for a batch of 15 samples). The blanks will be collected for sampling of OU-1 wells; these wells will be sampled using a portable pump that will be decontaminated between wells. Because OU-2 wells have dedicated pumps, equipment blanks will not be collected during OU-2 sampling.

Field blank and trip blank samples will be collected to check for possible cross-contamination of groundwater samples by VOCs from the point of sample collection to analysis of the samples by the laboratory. Field blanks will be collected at a rate of 10 percent of the primary samples (one blank for every 10 samples). Trip blanks will be collected only if VOCs are found in the equipment or field blank samples. Analyses for BOD, COD, and alkalinity do not require blanks.

Laboratory QC samples (MS/MSDs) will be identified for all analyses during each sampling event. One MS/MSD sample per analyte will be identified for every 20 primary samples collected. A double volume of sample is collected for each MS/MSD. Temperature blanks will be used to determine that the samples have been maintained at the appropriate temperature of 4 degrees Celsius (°C). Temperature blanks will be prepared each day samples are collected and will be included with each cooler of samples sent to the lab.

3.2.4 Laboratory Analysis

Unless otherwise noted, laboratory analyses will be performed by EPA's Region IX laboratory. In some instances (such as short sample holding times or unique analytical method requirements), a laboratory other than EPA's Region IX laboratory may be used. Groundwater samples will be analyzed by using the methods described below.

3.3 Investigation Derived Waste

Liquid and solid IDW will be generated during drilling, development, and sampling of the proposed monitoring wells. Each of these wastes may potentially be contaminated with VOCs. Samples of the drill cuttings, drilling fluids, and development water will be collected from their storage units prior to removal from the site to evaluate the proper storage,

disposal, or discharge of the waste materials. The following subsections describe each of the wastes and the sampling procedures that will be used to characterize the wastes.

3.3.1 Drill Cuttings and Fluids

Drill cuttings and fluids will be generated during drilling of the monitoring wells. The drill cuttings will be contained in roll-off bins stored at each well site. Two grab samples will be collected for every 50 cubic yards of drill cuttings. Samples will be collected from bins that contain cuttings representative of the dominant soil material encountered during drilling. In the past, attempts have been made to use photoionization detector (PID) organic vapor reading to select cuttings for analysis. However, based on previous experience in the Whittier Narrows OU and Puente Valley OU, no organic vapors have been detected during monitoring of drill cuttings during drilling and logging of the cuttings. Thus, PID organic vapor monitoring or readings are unlikely to be useful for screening cuttings for sample collection.

Drilling fluids (water and mud) will be containerized in tanks and stored onsite at each well location. One sample of drilling fluid will be collected per tank. It is likely that the drilling fluid in each tank will be fairly homogeneous as a result of recirculation, mixing, and agitation during the drilling process. Thus, one sample per tank should be sufficient to characterize the fluids in the tank. Because drilling mud tends to separate into the heavier mud at the bottom and lighter water near the top of the tank, the sampling bailer will be lowered near the bottom of the baker tank to collect a fluid sample with a high solids content.

The drill cuttings and fluids will be analyzed for the following, according to local landfill requirements:

- pH
- Flashpoint
- Total Petroleum Hydrocarbons – Gasoline (TPHg)
- Total Petroleum Hydrocarbons – Diesel (TPHd)
- VOCs
- Total Threshold Limit Concentration (TTLC) Metals

The analyses listed above have been performed on wastes generated previously during well installation activities associated with VOC contamination in the Whittier Narrows and South El Monte OUs and none of the wastes have been classified as hazardous. A quick turnaround time (7 days) will be necessary for characterization and disposal of the drill cuttings and fluids to avoid costs associated with long-term storage of the wastes.

3.3.2 Development and Purge Water

During development and sampling of the wells, water will be generated that has the potential to be contaminated. Water generated from well development and sampling activities will be contained in tanks and stored temporarily at a central location onsite. One groundwater sample per tank will be collected. It is likely that the water in each tank will be fairly homogeneous as a result of mixing and agitation during the tank filling. Thus, one sample per tank should be sufficient to characterize the water. When collecting the

sample from a tank, the sampling bailer will be lowered to the middle of the tank to avoid any water near the water surface that may have been affected by evaporation.

Well development and purge water samples will be analyzed for the following:

- VOCs
- SVOCs
- 1,2,3-Trichloropropane
- NDMA
- Perchlorate
- Nitrate
- 1,4-Dioxane
- Hexavalent Chromium
- Dissolved Metals

The rationale for the chemical analyses listed above is based on review of regulatory levels, as described in the companion QAPP, and evaluation of the parameters required to profile the liquid for treatment. A turnaround time of 7 days will be necessary to characterize and dispose of the development and purge water to avoid costs associated with long-term storage of the wastes.

SECTION 4

Request for Analyses

This section presents the request for analyses (RFA) and anticipated sampling schedule.

4.1 Analytical Parameters

Tables 4-1, 4-2, 4-3, and 4-4 summarize the analytical parameters and test methods for the samples that will be collected and submitted during the OU-2 quarterly groundwater sampling, discrete-depth sampling, waste water sampling, and waste soil sampling, respectively. The tables also indicate the sample preservation requirements, analytical holding times, sample container requirements, and the laboratory anticipated to perform the analysis. Unless otherwise noted, laboratory analyses will be performed by EPA's Region IX laboratory.

Target compound lists and reporting limits for all samples to be collected during this project (as approved by EPA) are included in Table A-1 (Appendix A). Standard turnaround times will be required for the quarterly groundwater sampling, 24-hour turnaround time will be required for the discrete-depth samples, and 5-day turnaround time will be required for IDW profiling samples. A mobile laboratory will be preferred for the analysis of the discrete-depth samples to accommodate the short turnaround time.

4.2 Schedule

The installation of the proposed wells and aquifer testing will proceed per EPA's direction. The start of this work is not anticipated before August 2004.

Groundwater sampling of existing wells was conducted in March and June 2004 and will continue on a quarterly basis. Groundwater sampling of the proposed wells will commence after they are constructed and will continue quarterly. EPA and OPOG monitoring wells will be sampled quarterly and semi-annually, respectively, for a period of 2 years.

Scheduling of future soil, soil gas, air, and groundwater sampling events will be coordinated with the EPA, OPOG, and CH2M HILL staff. It is anticipated that the soil gas and soil sampling activities will commence in 2005.

Table 4-1
Request for Analyses
Omega CU-2 EPA Superfund Site
Groundwater Monitoring Wells Sampling Schedule

[illegible]

Table 4-1
Request for Analysis
Omega OU-2 EPA Superfund Site
Groundwater Monitoring Wells Sampling Schedule

Anticipated Laboratory Performing Analysis			Organics		Emergent Compounds						Inorganics and Treatment/Discharge Parameters									
			CLP	CLP	EPA	EPA (or Truesdell)	MWH	EPA	EMAL	EPA	EPA	EPA	EPA	EPA	EPA	EPA	SPX	EPA	MWH	EPA
Method			EPA 824.3 ¹⁾	EPA 8270	EPA 814	Cal. DHS Liquid extraction CME or Cal. DHS purge and trap GC/MS	Med 1026	EPA 8260	EPA 218.6	EPA 800.7, EPA 806.1, EPA 805.1 ¹⁾	EPA 826.4	EPA 800.6	EPA 100.1	SM 5230 B	EPA 806.4	EPA 856.2	EPA 801.2	SM 5210B	SM 5220D	EPA 415.1
Specific Analyses Requested			VOCs (MTHB)	SVOCs	Parathion	1,2,3-Trichloropropane (1,2,3-TCP)	NEMA	5,5-Dibutyl-2,4-pyridinedione	Hexavalent Chromium	Dissolved TAL Metals (barium and effluent) ¹⁾	Cyanide	Bromide, Chloride, Fluoride, Sulfate, Nitrate-N + Nitrite-N, Orthophosphate-P	Total Dissolved Solids (TDS)	Alkalinity (hydroxide, carbonate, bicarbonate)	Total Phosphorus	Ammonia	TOC	Biological Oxygen Demand (BOD)	Chemical Oxygen Demand (COD)	Total Organic Carbon (TOC)
Preservatives			HCl to pH <2, chill to 4°C, no headspace	Chill to 4°C	Chill to 4°C	HCl to pH <2, chill to 4°C, no headspace	Chill to 4°C	Chill to 4°C	Chill to 4°C	0.45-um filter, HNO ₃ to pH<2, chill to 4°C	Chill to 4°C, NaOH to pH>12 ²⁾	Chill to 4°C	Chill to 4°C	Chill to 4°C, no headspace	Chill to 4°C, H ₂ SO ₄ to pH<2	Chill to 4°C, H ₂ SO ₄ to pH<2	Chill to 4°C, H ₂ SO ₄ to pH<2	Chill to 4°C	Chill to 4°C, H ₂ SO ₄ to pH<2	Total Organics, chl to pH<2, 4°C
Analytical Holding Time			Hold <14 days	Hold < 7 days prior to extraction; <40 days after	< 28 days	Hold <14 days	Hold <14 days	Hold <14 days prior to extraction; <40 days after extraction	< 24 hours	<28 days for Hg; <6 months for others	<14 days	<48 hours	<7 days	<14 days	<28 days	<28 days	<7 days	<48 hours	<28 days	<28 days
			# bottles/analysis				# bottles/analysis						# bottles/analysis							
Well Number	Sample ID	Sample Day	20-40 mL glass vial	2x1-L amber bottle	Collected together with Arsenic	20-40 mL glass vial	2x1-L amber bottle	1x1-L amber bottle	1x125 mL poly bottle	1x1-L poly bottle	1x500 mL poly bottle	Arsenic, TDS, Alkalinity collected together in 1x1-L poly bottle	Total Phosphorus, Ammonia, and TOC collected together in 1x1-L poly bottle	1x500 mL poly bottle	1x500 mL poly bottle	1x500 mL poly bottle	1x500 mL poly bottle	1x500 mL poly bottle	1x500 mL poly bottle	
PMW17A	OC2-PMW17A-W-0-44	Day 7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PMW17B	OC2-PMW17B-W-0-45	Day 7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PMW17C	OC2-PMW17C-W-0-46	Day 7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PMW18	OC2-PMW18-W-0-47	Day 7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PMW19	OC2-PMW19-W-0-48	Day 7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Duplicate																				
Field Blank																				
Equipment Blank																				
Trip Blank																				
Lab QC	OC2-QC-W-5-49	Day 7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PMW20A	OC2-PMW20A-W-0-50	Day 8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PMW20B	OC2-PMW20B-W-0-51	Day 8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PMW20C	OC2-PMW20C-W-0-52	Day 8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PMW21	OC2-PMW21-W-0-53	Day 8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PMW22	OC2-PMW22-W-0-54	Day 8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Duplicate	OC2-PMW22A-W-1-55	Day 8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Field Blank	OC2-QC-W-2-56	Day 8	X			X														
Equipment Blank																				
Trip Blank																				
Lab QC																				
Total Well Samples			43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	
Total Duplicates			5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
Total Field Blanks			4	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Equipment Blanks			1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Trip Blanks			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Laboratory QC (MS/MSD) Samples			3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Total Analyses			56	51	51	56	51	51	51	51	51	51	51	51	51	51	51	51	51	

Notes:
(A) pH readings to be reported for individual samples
(B) TAL Metals include: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium (total), cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc
(C) Also 0.9 grams of ascorbic acid if residual chlorine is expected
(D) OU-1 existing wells will be sampled on a semi-annual basis for 2 years; 1 day of field sampling assumed during each event
(E) OU-2 existing and proposed wells will be sampled on a quarterly basis for 2 years; 2 days of field sampling assumed for each event
(F) OU-2 proposed wells will be sampled on a quarterly basis for 2 years; 2 days of field sampling assumed for each event
Temperature (Temp) blanks will be prepared and sent with each cooler each day
Standard Laboratory return time for all samples
Lab QC = Matrix spike/matrix spike duplicate sample test which will be twice the normal sample volume
Lab: EPA = EPA Region IX Lab (Oakland, CA), Truesdell = Truesdell Laboratories, Inc. (Tustin, CA), MWH = MWH Laboratories (Pasadena, CA)

Table 4-2

Request for Analyses

Omega OU-2 EPA Superfund Site

Discrete Depth Groundwater Sampling

			Organics
Anticipated Laboratory Performing Analysis			EPA
Method			EPA 524.2 ^(A)
Specific Analyses Requested			VOCs (+MTBE)
Preservatives			HCl to pH <2; chill to 4C; no headspace
Analytical Holding Time			Hold <14 days
			# bottles/ analysis
OU-2 Proposed Wells	Sample ID	Sample Depth (ft) ^(B)	3x40 mL glass vial
PMW12	OU2-PMW12-W-0-58	50	X
PMW12	OU2-PMW12-W-0-59	60	X
PMW12	OU2-PMW12-W-0-60	70	X
PMW12	OU2-PMW12-W-0-61	80	X
PMW12	OU2-PMW12-W-0-62	90	X
Duplicate			
Equipment blank			
Field Blank	OU2-00-W-2-63		X
Lab QC			
PMW13	OU2-PMW13-W-0-64	50	X
PMW13	OU2-PMW13-W-0-65	60	X
PMW13	OU2-PMW13-W-0-66	70	X
PMW13	OU2-PMW13-W-0-67	80	X
PMW13	OU2-PMW13-W-0-68	90	X
Duplicate	OU2-PMW13-W-1-69	60	X
Equipment blank			
Field Blank	OU2-00-W-2-70		X
Lab QC			
PMW14	OU2-PMW14-W-0-71	50	X
PMW14	OU2-PMW14-W-0-72	60	X
PMW14	OU2-PMW14-W-0-73	70	X
PMW14	OU2-PMW14-W-0-74	80	X
PMW14	OU2-PMW14-W-0-75	90	X
Duplicate			
Equipment blank			

Table 4-2

Request for Analyses

Omega OU-2 EPA Superfund Site

Discrete Depth Groundwater Sampling

			Organics
Anticipated Laboratory Performing Analysis			EPA
Method			EPA 524.2 ^(A)
Specific Analyses Requested			VOCs (+MTBE)
Preservatives			HCl to pH <2; chill to 4C; no headspace
Analytical Holding Time			Hold <14 days
			# bottles/ analysis
OU-2 Proposed Wells	Sample ID	Sample Depth (ft) ^(B)	3x40 mL glass vial
Field Blank	OU2-00-W-2-76		X
Lab QC			
PMW15	OU2-PMW15-W-0-77	50	X
PMW15	OU2-PMW15-W-0-78	60	X
PMW15	OU2-PMW15-W-0-79	70	X
PMW15	OU2-PMW15-W-0-80	80	X
PMW15	OU2-PMW15-W-0-81	90	X
Duplicate	OU2-PMW15-W-1-82	60	X
Equipment blank			
Field Blank	OU2-00-W-2-83		X
Lab QC	OU2-00-W-5-84		X
PMW16	OU2-PMW16-W-0-85	50	X
PMW16	OU2-PMW16-W-0-86	60	X
PMW16	OU2-PMW16-W-0-87	70	X
PMW16	OU2-PMW16-W-0-88	80	X
PMW16	OU2-PMW16-W-0-89	90	X
Duplicate			
Equipment blank			
Field Blank	OU2-00-W-2-90		X
Lab QC			
PMW17	OU2-PMW17-W-0-91	50	X
PMW17	OU2-PMW17-W-0-92	60	X
PMW17	OU2-PMW17-W-0-93	70	X
PMW17	OU2-PMW17-W-0-94	80	X
PMW17	OU2-PMW17-W-0-95	90	X

Table 4-2

Request for Analyses

Omega OU-2 EPA Superfund Site

Discrete Depth Groundwater Sampling

Anticipated Laboratory Performing Analysis			Organics
Method			EPA
Specific Analyses Requested			EPA 524.2 ^(A)
Preservatives			VOCs (+MTBE)
Analytical Holding Time			HCl to pH <2; chill to 4C; no headspace
			Hold <14 days
			# bottles/ analysis
OU-2 Proposed Wells	Sample ID	Sample Depth (ft) ^(B)	3x40 mL glass vial
Duplicate	OU2-PMW17-W-1-98	80	X
Equipment blank			
Field Blank	OU2-00-W-2-97		X
Lab QC			
PMW18	OU2-PMW18-W-0-98	50	X
PMW18	OU2-PMW18-W-0-99	60	X
PMW18	OU2-PMW18-W-0-100	70	X
PMW18	OU2-PMW18-W-0-101	80	X
PMW18	OU2-PMW18-W-0-102	90	X
Duplicate			
Equipment blank			
Field Blank	OU2-00-W-2-103		X
Lab QC			
PMW19	OU2-PMW19-W-0-104	50	X
PMW19	OU2-PMW19-W-0-105	60	X
PMW19	OU2-PMW19-W-0-106	70	X
PMW19	OU2-PMW19-W-0-107	80	X
PMW19	OU2-PMW19-W-0-108	90	X
Duplicate	OU2-PMW19-W-1-109	50	X
Equipment blank			
Field Blank	OU2-00-W-2-110		X
Lab QC	OU2-00-W-5-111		X
PMW20	OU2-PMW20-W-0-112	50	X
PMW20	OU2-PMW20-W-0-113	60	X
PMW20	OU2-PMW20-W-0-114	70	X

Table 4-2

Request for Analyses

Omega OU-2 EPA Superfund Site

Discrete Depth Groundwater Sampling

			Organics
Anticipated Laboratory Performing Analysis			EPA
Method			EPA 524.2 ^(A)
Specific Analyses Requested			VOCs (+MTBE)
Preservatives			HCl to pH <2; chill to 4C; no headspace
Analytical Holding Time			Hold <14 days
			# bottles/ analysis
OU-2 Proposed Wells	Sample ID	Sample Depth (ft) ^(B)	3x40 mL glass vial
PMW20	OU2-PMW20-W-0-115	80	X
PMW20	OU2-PMW20-W-0-116	90	X
Duplicate			
Equipment blank			
Field Blank	OU2-00-W-2-117		X
Lab QC			
PMW21	OU2-PMW21-W-0-118	50	X
PMW21	OU2-PMW21-W-0-119	60	X
PMW21	OU2-PMW21-W-0-120	70	X
PMW21	OU2-PMW21-W-0-121	80	X
PMW21	OU2-PMW21-W-0-122	90	X
Duplicate	OU2-PMW21-W-1-123	60	X
Equipment blank			
Field Blank	OU2-00-W-2-124		X
Lab QC			
PMW22	OU2-PMW22-W-0-125	50	X
PMW22	OU2-PMW22-W-0-126	60	X
PMW22	OU2-PMW22-W-0-127	70	X
PMW22	OU2-PMW22-W-0-128	80	X
PMW22	OU2-PMW22-W-0-129	90	X
Duplicate			
Equipment blank			
Field Blank	OU2-00-W-2-130		X
Lab QC	OU2-00-W-5-131		X
Total Well Samples			55

Table 4-2

Request for Analyses

Omega OU-2 EPA Superfund Site

Discrete Depth Groundwater Sampling

			Organics
Anticipated Laboratory Performing Analysis			EPA
Method			EPA 524.2 ^(A)
Specific Analyses Requested			VOCs (+MTBE)
Preservatives			HCl to pH <2; chill to 4C; no headspace
Analytical Holding Time			Hold <14 days
			# bottles/ analysis
OU-2 Proposed Wells	Sample ID	Sample Depth (ft) ^(B)	3x40 mL glass vial
Duplicate			5
Equipment Blank			0
Field Blank			11
Lab QC (MS/MSD) Samples			3
Total Analyses			74
Notes: (A) pH readings to be reported for individual samples (B) Sample depths shown are tentative; they may be modified in the field based on encountered lithology 24-hour laboratory return time for all samples Temperature (Temp) blanks will be prepared and sent with each cooler each day Lab QC = Matrix spike/matrix spike duplicate (MS/MSD) sample set which will be twice the normal sample volume Labs: EPA = EPA Region IX Lab (Oakland, CA)			

Table 4-3
Request for Analyses
Omega OU-2 EPA Superfund Site
Investigative Derived Waste - Water

		Organics					Inorganics			
Anticipated Laboratory Performing Analysis		CLP	CLP	EPA	MWH	EPA	EMAX	EPA	EPA	EPA
Method		EPA 524.2 ^(A)	EPA 8270	Cal. DHS liquid extraction C/MS or Cal. DHS purge and trap GC/MS	Mod EPA 1625	EPA 8270/SIM	EPA 218.6	EPA 200.7, EPA 200.8, EPA 200.9, EPA 245.1	EPA 314	EPA
Specific Analyses Requested		VOCs	SVOCs	1,2,3-trichloropropane	NDMA	1,4-Dioxane	Hexavalent Chromium	Dissolved Metals	Perchlorate	Nitrate-N
Preservatives		HCl to pH <2; chill to 4C; no headspace	Chill to 4° C	HCl to pH <2; chill to 4C; no headspace	Chill to 4° C	Chill to 4° C	Chill to 4° C	0.45-um filter, HNO3 to pH<2, chill to 4° C	Chill to 4° C	Chill to 4° C
Analytical Holding Time		Hold <14 days	Hold < 7 days prior to extraction; <40 days after	Hold <14 days	Hold <7days prior to extraction; <40 days after extraction	Hold <7days prior to extraction; <40 days after extraction	< 24 Hours	<28 days for Hg <6 months for others	< 28 days	<48 hours
Contract Holding Time		Hold <10 days	Hold < 7 days prior to extraction; <40 days after	Hold <10 days	Hold <7days prior to extraction; <40 days after extraction	Hold <7days prior to extraction; <40 days after extraction	< 12 Hours	<26 days for Hg <6 months for others	< 26 days	<12 hours
		# bottles/ analysis					# bottles/ analysis			
	Sample ID	3x40 mL glass vial	2x1-L amber bottle	3x40 mL glass vial	2x1-L amber bottle	2x1-L amber bottle	1x125 mL poly bottle	1x1-L poly bottle	Collected together in 1x250 mL poly bottle	
55-gal drum (each) ^(B)	OC2-IDW-W-0-132	1	1	1	1	1	1	1	1	1
Notes (A) pH readings to be reported for individual samples (B) Groundwater generated during purge sampling/aquifer testing/well development from OU-1 existing wells, OU-2 existing wells, and OU-2 proposed wells will be discharged and mixed in 55-gallon drums, then disposed of offsite. Temperature (Temp) blanks will be prepared and sent with each cooler each day Labs: EPA = EPA Region IX Lab (Oakland, CA) Lab QC = Matrix spike/matrix spike duplicate sample set which will be twice the normal sample volume										

Table 4-4

Request for Analyses

Omega OU-2 EPA Superfund Site

Investigative-Derived Waste (drill cuttings and drilling mud)

Anticipated Laboratory Performing Analysis		Organics					Inorganics
Method		EPA 8010/8020	EPA 8045	EPA 1010	8015-Gasoline	8015-Diesel	EPA 6010/7471
Specific Analyses Requested		8000s	pH	Flashpoint	Total Petroleum Hydrocarbons - gasoline (TPHg)	Total Petroleum Hydrocarbons - diesel (TPHD)	CAC Title 22 Total Threshold Limit Concentration (TTLC) Metals
Preservatives		Chill to 4° C	Chill to 4° C	Chill to 4° C	Chill to 4° C	Chill to 4° C	Chill to 4° C
Analytical Holding Time		< 48 hours	< 7 days	NA	< 48 hours (gas)	< 14 days prior to extraction, 40 days after extraction (diesel)	< 6 months (28 days for mercury)
Contract Holding Time		< 48 hours	< 5 days	NA	< 48 hours (gas)	< 14 days prior to extraction, 40 days after extraction (diesel)	< 6 months (28 days for mercury)
		# bottles/ analyze					
Sample ID		30-ounce containers	pH, Flashpoint, TPHg, and TPHd to be combined in 1x8-ounce glass jar				1x8-ounce glass jar
PMW 12							
Roll Off Bin (each) ^(A)	OC2-IDW-S-0-133	2	2	2	2	2	2
Duplicate							
Field Blank							
Trip Blank							
Lab QC (MS/MSD) Samples							
PMW 13							
Roll Off Bin (each) ^(A)	OC2-IDW-S-0-138	2	2	2	2	2	2
Duplicate							
Field Blank							
Trip Blank							
Lab QC (MS/MSD) Samples							
PMW 14							
Roll Off Bin (each) ^(A)	OC2-IDW-S-0-143	2	2	2	2	2	2
Duplicate							
Field Blank							
Trip Blank							
Lab QC (MS/MSD) Samples							
PMW 15							
Roll Off Bin (each) ^(A)	OC2-IDW-S-0-148	2	2	2	2	2	2
Duplicate							
Field Blank							
Trip Blank							
Lab QC (MS/MSD) Samples							
PMW 16							
Roll Off Bin (each) ^(A)	OC2-IDW-S-0-153	2	2	2	2	2	2
Duplicate							
Field Blank							
Trip Blank							
Lab QC (MS/MSD) Samples							
PMW 17							
Roll Off Bin (each) ^(A)	OC2-IDW-S-0-158	2	2	2	2	2	2
Duplicate							
Field Blank							
Trip Blank							
Lab QC (MS/MSD) Samples	OC2-IDW-S-5-159	1	1	1	1	1	1
PMW 18							
Roll Off Bin (each) ^(A)	OC2-IDW-S-0-163	2	2	2	2	2	2
Duplicate							
Field Blank							
Trip Blank							
Lab QC (MS/MSD) Samples							
PMW 19							
Roll Off Bin (each) ^(A)	OC2-IDW-S-0-168	2	2	2	2	2	2
Duplicate							
Field Blank							
Trip Blank							
Lab QC (MS/MSD) Samples							
PMW 20							
Roll Off Bin (each) ^(A)	OC2-IDW-S-0-173	2	2	2	2	2	2
Duplicate							

Table 4-4
Request for Analyses
Omega OU-2 EPA Superfund Site
Investigative-Derived Waste (drill cuttings and drilling mud)

Anticipated Laboratory Performing Analysis		Organics					Inorganics
Method		EPA	EPA	EPA	EPA	EPA	EPA
Specific Analyses Requested		EPA 5035/8280	EPA 9045	EPA 1010	8015-Gasoline	8015-Diesel	EPA 6010/7471
Preservatives		VOCs	pH	Flashpoint	Total Petroleum Hydrocarbons - gasoline (TPHg)	Total Petroleum Hydrocarbons - diesel (TPHd)	CAC Title 22 Total Threshold Limit Concentration (TTLIC) Metals
Analytical Holding Time		Chill to 4° C	Chill to 4° C	Chill to 4° C	Chill to 4° C	Chill to 4° C	Chill to 4° C
Contract Holding Time		< 48 hours	< 7 days	NA	< 48 hours (gas)	< 14 days prior to extraction, 40 days after extraction (diesel)	< 6 months (28 days for mercury)
		< 48 hours	< 5 days	NA	< 48 hours (gas)	< 14 days prior to extraction, 40 days after extraction (diesel)	< 6 months (28 days for mercury)
# bottles/ analyses							
	Sample ID	3xEncore containers	pH, Flashpoint, TPHg, and TPHd to be combined in 1x8-ounce glass jar				1x8-ounce glass jar
Field Blank							
Trip Blank							
Lab QC (MS/MSD) Samples							
PMW21							
Roll Off Bin (each) ^(A)	OC2-IDW-S-0-178	2	2	2	2	2	2
Duplicate							
Field Blank							
Trip Blank							
Lab QC (MS/MSD) Samples							
PMW22							
Roll Off Bin (each) ^(A)	OC2-IDW-S-0-183	2	2	2	2	2	2
Duplicate							
Field Blank							
Trip Blank							
Lab QC (MS/MSD) Samples	OC2-IDW-S-5-187	1	1	1	1	1	1
Total Analyses		24	24	24	24	24	24
Notes ^(A) Drill cuttings and drilling fluid produced during construction of each proposed OU-2 monitoring well will be temporarily stored in roll off bins, then disposed of offsite. Temperature (Temp) blanks will be prepared and sent with each cooler each day. Labs: EPA = EPA Region IX Lab (Oakland, CA) Laboratory QC = Matrix spike/matrix spike duplicate sample set that will be twice the normal sample volume (equivalent to two samples)							

SECTION 5

Field Methods and Procedures

This section of the FSP provides information on field activities associated with the OU-2 study area. Included in this section are methods and procedures for the following:

- Soil gas and soil sampling
- Monitoring well drilling and construction
- Groundwater sampling
- Aquifer testing
- Use of sample containers and preservatives
- Decontamination
- Containment and disposal of IDW
- Sample management and documentation
- QC sample collection

5.1 Monitoring Well Construction

5.1.1 Well Drilling

Monitoring wells constructed for the OU-2 investigation will either be drilled using the dual-tube percussion hammer (dual-tube) method, air-rotary/casing-hammer (ARCH) method, or the mud-rotary method. The shallow and intermediate monitoring wells will be drilled using the dual-tube or ARCH methods. Drilling mud may be used during construction of the deeper monitoring wells or where collapsing of the borehole is encountered during drilling of the shallow and intermediate wells. Each drilling method is briefly described below. The determination of which drilling method to use will be made based on the overall technical approach and cost of subcontractor bids. Before drilling, the presence of underground utilities will be verified by Underground Service Alert (USA). A geophysical contractor will be called to survey drilling locations for which USA does not provide service. In addition, each boring will be started with a hand-auger or an air-knife to a depth of at least 5 feet to uncover any unknown or undetected utilities.

5.1.1.1 Dual-tube Percussion Hammer Method

The dual-tube drilling tooling consists of two nested drive casings advanced by a percussion hammer. Compressed air is circulated down the annulus between the two drive casings and up within the central drive casing (reverse air circulation), bringing the drill cuttings to the surface. Drill cuttings are discharged into a cyclone separator. The advantage to this method is that the borehole remains sealed by the drive casing at all times, thus reducing the production of groundwater during drilling. Drilling mud is not required to keep the borehole open. The method of air circulation also reduces the potential for compressed air intrusion into the adjacent formation compared to direct air rotary. Therefore, this method is expected to result in more representative discrete groundwater samples.

Discrete-depth groundwater samples will be collected with a disposable bailer from every permeable unit encountered or intervals of approximately every 10 feet, whichever is less. The samples will be used to construct a depth profile of relative VOC concentrations in groundwater that will be used to select the well screen depth interval. The data will be used to screen the depth range containing the highest relative VOC concentration, not to assess the actual VOC concentration. Potential effects on the aquifer immediately surrounding the borehole from intrusion of compressed air will be minimized by thorough development of each well, so that samples collected from the completed wells will provide accurate measurement of the local groundwater VOC concentrations. While the dual-tube method does have the potential to reduce the VOC concentrations in the in situ groundwater samples collected during drilling, the impacts are not anticipated to significantly affect decisions based on the data.

Because of sandier lithologic conditions in the Santa Fe Springs area at the southwestern end of the contaminant plume, the dual-tube drilling method may not be able to complete some or all of the borings, particularly the deeper borings, in this area. If the dual-tube drill rig cannot complete a boring because of problems with excessive groundwater production or heaving sands, the drilling will continue using mud-rotary drilling methods.

5.1.1.2 Air-Rotary Casing-Hammer Drilling

The ARCH method consists of a single drive casing advanced by a percussion hammer. Compressed air is circulated down the drill stem and up within the annular space between the drill stem and drive casing (direct air circulation). Drill cuttings are discharged into a cyclone separator. Drilling mud is not required to keep the borehole open. The borehole remains sealed by the drive casing during drilling. Discrete-depth groundwater samples can be collected using the same procedures as during dual-tube drilling. Potential effects on the groundwater around the borehole will be minimized by thorough well development. Overall, this drilling method is similar to the dual-tube method; the drilling speed is generally slower. However, the major advantage of the ARCH method is that the drill rig can be converted to mud-rotary drilling if flowing sands are encountered. Such conversion is not available for dual-tube rigs.

5.1.1.3 Mud-Rotary Drilling

Drilling mud may be used during construction of the deeper monitoring wells or where borehole instability is encountered during drilling of the shallow and intermediate wells. Typically, mud-rotary methods are implemented to minimize borehole collapse and to assist in evacuating drill cuttings from the boreholes. Drilling mud is expected to reduce the possibility of cross contamination between groundwater zones, because it continuously invades the formation along the borehole walls and forms a low-permeability mud cake.

Drilling mud will consist of bentonite and water. No other additives will be permitted in the mud unless approved by the site hydrogeologist and EPA remedial project manager (RPM). The viscosity and density of the drilling mud will be tested periodically and maintained within the limits specified by the site hydrogeologist or engineer. Drilling mud will be forced down the drill pipe and out through ports in the drill bit utilizing the minimum quantity of mud required to evacuate drill cuttings from the borehole.

5.1.2 Well Testing

5.1.2.1 Lithologic Sampling

Borehole drill cuttings will be collected for lithologic logging every 10 feet or at changes in lithology. Samples will be collected, lithologically logged by the field hydrogeologist and screened for organic contaminants with a photoionization detector. Following completion of the borings, samples will be disposed of with the rest of the drill cuttings. Downhole soil samples will not be collected for laboratory analysis.

5.1.2.2 Discrete Groundwater Sampling

In situ, depth-profile samples will be collected during drilling. It is anticipated that the boring will be advanced approximately 50 feet into the saturated zone and samples taken about every 10 feet beginning at the water table (approximately 30 to 70 feet bgs). These sample depths are tentative; actual sample depths will be selected based on encountered lithology with the goal of sampling permeable (coarse grained) units. The total anticipated boring depth will be 150 feet bgs or less.

For planning purposes, it is assumed that 5 in situ groundwater samples will be collected at each well, for a total of 55 environmental field samples (not including duplicates, blanks, and QC samples). Samples will be analyzed for VOCs (the primary contaminants of concern), as discussed in Section 4. The sample results will need to be available in time for determining the well construction; an onsite mobile laboratory will be required.

In situ groundwater samples will be collected during drilling of the intermediate wells, beginning at the water table and extending every 10 to 20 feet to the total depth of the well. Additional samples may be collected at the discretion of the onsite geologist, with the intention to sample saturated sand horizons. For planning purposes, five groundwater samples are assumed for each well. Discrete-depth sampling is not anticipated during drilling of the extraction well (PEW1).

At each in situ groundwater sampling depth, the hole will be cleared of all drill cuttings, and all water in the hole will be evacuated by circulating compressed air. Air circulation will then be shut off to allow formation water to enter the drive casing. An in situ grab sample will be collected using a polyethylene bailer when the water level has recovered approximately 3 feet up within the drive casing. Only the discrete groundwater samples will be collected using a bailer. It is not practical, and it would be costly, to build temporary wells to collect these screening samples using low-flow sampling techniques. Disposable bailers will be used, so decontamination of the bailers is not required. A 100-pound-test monofilament fishing line will be attached to the bailer and used to lower and retrieve the bailer. A new piece of line will be used for each sample. The bailer will be lowered through the annulus between the nested drive casings, quickly pulled to the surface, and an adapter specifically designed for the delivery of VOC samples (low-flow device) will be used to transfer water from the bailer to prepreserved volatile organic analysis (VOA) vials.

The samples will not be filtered in the field to avoid the loss of volatile organic compounds (VOCs). The mobile laboratory analyzing the samples may or may not filter them; analysis of unfiltered samples will be acceptable.

5.1.2.3 Geophysical Logging

Mud-rotary boreholes will be geophysically logged immediately upon completion of the pilot hole for each well. Results from the geophysical logging will help determine the casing depth and well screen interval. Geophysical logs to be performed will include electrical resistivity (long and short normal) and spontaneous potential. Additional logs such as caliper or natural gamma ray may be conducted if deemed necessary. Dual-tube or ARCH boreholes cannot be geophysically logged prior to well installation. Wells installed in boreholes drilled by these methods may be logged using the induction and natural gamma methods, if deemed necessary. For the induction logging to be meaningful, the wells would have to be constructed entirely using polyvinyl chloride (PVC).

5.1.3 Well Construction

All single-screen monitoring wells will be constructed using 4-inch-diameter, flush-threaded Schedule 80 PVC casing and 4-inch-diameter (slotted) well screen (Figure 5-1). Wells installed in areas of high concentrations of chlorinated hydrocarbons (approximately over 1,000 $\mu\text{g/L}$) may be installed with Schedule 80 PVC casing and Type 316 stainless steel, continuous wire-wrapped, 0.020-inch slot well screens. Wells in low concentration zones will be installed with slotted (0.02-inch) PVC screens. Well construction details are summarized in Table 5-1.

Well clusters will be constructed as multiple-completion wells with two to three casings (and screens) within a single borehole. The diameter of the casings and screens will be 2 inches. Figure 5-2 presents a typical multiple completion well diagram.

A 5-foot, Type 316 stainless steel or PVC, as appropriate, sediment trap with end cap will be installed below each screen. All monitoring well screens are anticipated to be 10 feet long; longer screens (15 or 20 feet) may need to be installed in thick permeable units. Centralizers will be used above and below the well screen and every 40 feet above the screen if the ARCH or mud-rotary methods are used. Centralizers will not be needed if the well is constructed by the dual-tube method, as the casing is centered by the inner drive tube during well constructions.

Extraction Well PEW1 will be installed with a 5-inch-diameter, Schedule 80 PVC casing, a 20-foot, 0.02- or 0.03-inch slot PVC or continuous stainless steel wire-wrap screen, and a 5-foot sediment trap.

The filter pack is anticipated to be No. 3 Monterey sand (or equivalent). A transition sand will be placed between the filter pack and the casing seal. The seal will be constructed using bentonite pellets or chips, which will be hydrated in place. The annular space above the seal will be filled with a cement-bentonite grout made with Portland cement and Aquaseal and/or Volclay grout (Aquaseal and Volclay are trade names for an inert, sodium bentonite). Bentonite seals will also be placed between the screen intervals of multiple-completion wells.

Surface completions for each well will include flush-mount, traffic-rated well vaults set in concrete. Locks will be installed on each well to prevent vandalism and unauthorized access.

5.1.4 Well Development

Monitoring wells will be developed prior to groundwater sampling by bailing, surging, and pumping with a temporary high-capacity submersible pump. The development water will be contained and sampled for future treatment. The high-solids, turbid water removed from the well initially will be stored with the drilling fluids. Less turbid water removed during the later stages of the development will be stored in a separate container.

Well development will be performed after the grout used to construct the well has been allowed to set at least 48 hours. The extracted water pH, specific conductivity, turbidity, and temperature will be recorded during the development in a field logbook. Water clarity will be measured and recorded upon completion of the well development with a nephelometric turbidity unit (NTU) meter or equivalent. Development will continue until water quality parameters are stable.

The well development requirements are as follows:

- The suspended sediment content of the water is less than 0.75 milliliter per liter (mL/L), as measured in an Imhoff cone according to method E160.5.
- The water turbidity remains within a 10 NTU range for at least 30 minutes, and the water temperature, pH, and electrical conductivity (EC) have stabilized (temp = ± 1 degree C, pH = ± 0.1 units, and EC = $\pm 5\%$).
- No sediment shall remain in the bottom of the well.

All development equipment will be decontaminated prior to start. The development process will be purely mechanical (i.e., no chemical additives will be introduced into the well).

5.2 Land Surveying

Surveying activities will be conducted by a qualified surveying subcontractor licensed in the State of California. The following land surveying activities may be conducted at OU-2:

- Obtaining elevations of groundwater monitor wells, the extraction well, soil borings, and soil gas survey points to an accuracy of 0.01 foot, referenced to msl.
- Establishing the elevation reference point for wells at the north rim of the top of the inner PVC well casing, and a permanent mark designating the elevation point. The ground surface elevation for each well and boring will be established to an accuracy of 0.01 foot.
- The horizontal datum of reference will be the North American Datum of 1983, 1991 adjustment (NAD91). Coordinates will be reported in the California State Plane Coordinate System, North Zone, in U.S. survey feet. Horizontal control shall be established to 0.1 foot.
- The location of each well and sampling point will be tied into a permanent land monument (e.g., building corners).

5.3 Groundwater Sample Collection

Groundwater samples will be collected from the existing and proposed EPA wells, existing OPOG wells, and the proposed extraction well. The following subsections describe sample collection procedures that will be used during the monitoring program described in this FSP. These procedures do not apply to the collection of the discrete groundwater samples during the well installation (Section 5.1.2.2).

5.3.1 OPOG Wells

OPOG currently samples the OU-1 wells semiannually by purging three casing and gravel pack volumes before collecting samples, using a submersible pump. A casing volume is calculated by multiplying the head of water in the casing (well depth minus depth-to-water) by the cross-sectional area of the casing (πr^2). Determination of a casing volume is based on measurements of the depth-to-water at the time of sampling using an electric sounder. During each purge, water quality parameters (pH, temperature, specific conductance, and turbidity) are monitored and recorded. All purge water is containerized and disposed at an offsite facility.

CH2M HILL will use the low-flow sampling method also for the OU-1 wells. Using the same sampling technique will provide for more consistent results from OU-1 and OU-2 wells. The sampling procedures will be the same as described in the next section for the OU-2 wells, with the exception that a portable pump will be used. The pump will be decontaminated between sampling of different wells using procedures described in Section 5.6.

5.3.2 EPA Wells

Existing and proposed EPA monitoring wells will be equipped with dedicated bladder pumps to allow sampling using low-flow sampling techniques. Low-flow groundwater sampling is the process of purging and sampling wells at low flow rates from within the well screen zone to minimize purging and improve sample quality. Low-flow groundwater sampling has the advantage of producing a representative groundwater sample with far less total well purge water than is obtained from conventional sampling of monitoring wells, in which three well volumes are purged prior to sampling. Samples collected by the low-flow sampling method have been shown to be more representative than samples collected by the three-well-volume purge method. Low-flow purging and sampling refers to the velocity with which water enters the pump intake, not necessarily to the flow rate of water discharged at the surface. Water-level drawdown provides the best indication of the stress imparted by a given flow rate for a given hydrological situation. The proper flow rate for each well will be based on the ability to establish a low-flow rate at an acceptable level of drawdown (0.2 to 0.3 foot), and with minimum fluctuations of that water level during pumping. To achieve this, the pump will be initially operated at the minimum flow capacity of the pump, then the flow rate will be gradually increased until some initial drawdown is observed. The flow rate will then be reduced slightly to achieve a stabilized purge rate for the well. It is anticipated that flow rates on the order of 0.1 to 0.5 liter per minute (L/min) will be achieved. However, the flow rate will not exceed 1.0 L/min in any case.

Careful, continuous measurement of field parameters including pH, temperature, specific conductance, dissolved oxygen (DO), oxidation-reduction potential (ORP) will be used to assess when purged water has reached equilibrium. The time interval between readings will be dictated by the stabilized pumping rate for each well (typically between 1 and 3 minutes). An initial change in the measurements typically indicates that water is being drawn from a different source ("active" versus "stagnant" water). Stabilization of these parameters would indicate that the water is coming from a steady-state source (the formation immediately surrounding the well screen near the pump intake). Equilibrium conditions are sometimes achieved after extraction of less than 10 liters, with 4 to 8 liters being the average reported in published studies. Therefore, the volume of water removed by this method during purging will be considerably less than with conventional purging techniques.

Accurate measurement of the field parameters will require a flow-through cell or other means to ensure that the purge water is continuously monitored. Although the flow-through cell is the preferred method, an acceptable alternate method is placing the probes in a small bucket or beaker that continuously overflows, with the discharge tubing placed near the probes, and covering the beaker or bucket with clear plastic film (such as Saran Wrap®). Each well will be pumped until the measured field parameters (temperature, pH, turbidity, and EC) have stabilized within 10 percent over three successive readings prior to collecting samples.

5.3.3 Field Parameters Measurement

A conventional pH meter with a combination gel-filled electrode or equivalent will be used for field pH and temperature measurements (digital readout). A combination conductivity-temperature-salinity-ORP meter will be used for specific conductance and oxidation-reduction potential measurements. Turbidity measurements will be made with a digital readout turbidity meter (readout in nephelometric turbidity units [NTU]). Samples for field measurements will be collected in a beaker used solely for field parameter determinations. All probes will be thoroughly rinsed with distilled water prior to, and between, any measurements at each well.

When using the low-flow sampling technique, flow-through cells will be used to measure the field parameters. Low-flow rate purging, sampling, and field parameter measurement of this nature is often referred to as "micro-purge" sampling and results in quicker sampling, generation of less purge water, and more representative sampling results.

Equipment used to measure field parameters will be maintained and calibrated according to manufacturer's specifications. At a minimum, calibration will occur at the start of each day, and will be recorded in the field logbook along with the equipment serial number.

5.4 Aquifer Testing

The proposed aquifer testing program will include slug tests, pumping tests, and specific capacity tests.

5.4.1 Slug Tests

Rising and falling head slug tests will be performed in new and existing EPA and OPOG monitoring wells to evaluate aquifer hydraulic conductivity in the vicinity of the well. Slug tests will be performed after groundwater sampling using solid PVC slugs with clean bailer rope. A pressure transducer attached to an electronic recording device, such as an In Situ Hermit, will be used to record changes in pressure associated with water level recovery. Tests will be repeated two times to verify reproducibility. If the test well response is extremely slow, one test may be conducted. Multiple tests using different initial displacement will be conducted at rapidly responding wells.

5.4.2 Constant Rate Pumping Tests

Aquifer tests will be conducted on the existing SFS#1 and the proposed extraction well PEW1. Each test will consist of an initial step-drawdown test to determine the optimal pumping rate for the full pumping test, and a 72-hour constant flow rate test to define the hydraulic properties of the aquifer. Based on the drawdown response in observation wells, the duration of the test at PEW1 may be shortened to minimize the amount of waste water. Such consideration is not required for the test at SFS#1 because a wellhead treatment system is in place.

Nearby monitoring wells will serve as observation points. Well cluster MW08ABCD will be monitored during the PEW1 test. Wells MW04, MW05, MW06, MW08ABCD, MW09AB, MW10, MW11, PMW16, and PMW17ABC will be monitored during the test on SFS#1.

Water levels in the pumping and observation wells and barometric pressure will be monitored using pressure transducers attached to data loggers. Water levels and barometric pressure will be monitored for at least 72 hours prior to pumping, during pumping, and at least 24 hours after pumping. Discharge rate will also be monitored and recorded continuously during the pumping tests.

Short-term constant-rate pumping tests will be conducted at two new well clusters near the leading edge of the contaminant plume. Tentatively, the tests will be conducted at PMW15 and PMW18. The test locations may be revised based on the investigation results. The tests will be conducted immediately after well development using a portable submersible pump and the development rig.

The test will be conducted consecutively on all three wells (anticipated) within the cluster. The test duration of 2 to 4 hours of pumping will be followed by complete recovery to pre-pumping conditions. A step-drawdown test may be conducted prior to the constant rate test to establish pump rates, if needed. Water levels in all wells of the cluster, as well as barometric pressure, will be monitored using a pressure transducer and data logger. The flowrate will be measured at least every 15 minutes. Water levels and barometric pressure will be monitored for 24 hours prior to the test and for 24 hours after the test.

The containment and disposal of the extracted groundwater is described in Section 5.7.2.

5.4.3 Specific Capacity Tests

As part of the well development, the wells will be pumped using a portable submersible pump. Depth to water and flowrate will be measured during the pumping to estimate the

well specific capacity (sustainable flowrate at a given drawdown). The specific capacity provides an indirect indication of aquifer properties. When practical, time-drawdown data will also be collected and analyzed as pumping test data.

5.5 Sample Containers and Preservatives

Sample container requirements and preservation methods for each analysis are summarized in Table 4-1 (previously presented). Sample containers will be laboratory-provided or purchased with certificates of cleanliness from approved laboratory product suppliers.

5.5.1 Groundwater

Samples to be analyzed for VOCs will be collected in three 40-mL glass VOA vials. A sufficient amount of 1:1 hydrochloric acid (HCl) will be placed inside the vials to lower the sample pH to less than 2.

Samples will be tested to ensure that sufficient preservatives have been added (e.g., a test bottle or vial), and the test bottles will be filled and checked to determine if sufficient preservatives have been added using the following (or similar) steps:

- Add preservative to test sample vial.
- Fill with sample, cap, and invert to ensure mixing.
- Test the pH to determine if less than 2 is achieved; if so, add same amount of preservative to the actual sample vial and collect the sample; discard the test vial.
- Add more preservative and repeat until pH less than 2 is achieved.

Many laboratories provide pre-acidified VOA-sample vials and these will be used, if available from the laboratory. A field check of the amount of preservative contained in the pre-acidified VOA vials will be conducted similar to the approach described above to confirm that sufficient preservative has been provided. If the pre-acidified VOA vials do not contain enough preservative to achieve the proper pH (<2), additional preservative will be added to the vial and repeated until the proper pH is achieved. This additional amount of preservative will then be added to each sample container prior to collection of samples.

The vials will be filled so that no headspace is present after sample collection. Filled containers will be checked by inverting the vial and tapping to reveal any air bubbles. If air bubbles are present, containers will be emptied, re-acidified, and refilled. If, after several attempts at sample collection, air bubbles remain, the sample will be described in the field notebook as an "aerated sample."

VOA vials will be cooled to 4°C and stored away from sunlight prior to shipping by immediately placing the full sample bottle into an iced cooler. The maximum analytical holding time for VOCs will be 14 days.

Samples for dissolved metals analysis will be passed through a 0.45-micron filter immediately after collection. The samples will subsequently be preserved by addition of nitric acid to a pH less than 2. The pH paper should not be inserted into the bottle as the dyes used contain metals. Samples will be placed into 1-liter polyethylene bottles and

cooled to 4°C. The maximum analytical holding time for dissolved metals will be 6 months. If the groundwater samples contain enough suspected solids that filtration in the field is slow enough to delay sampling, then the samples will be submitted unfiltered to the lab, and the lab will be asked to filter the samples immediately upon receipt.

Samples for **hexavalent chromium** will be placed in one 125-mililiter (mL) polyethylene bottle and chilled to 4°C. The analytical holding time for this method will be 24 hours.

Samples collected for **perchlorate** will be placed in one 250-mL polyethylene bottle or together with nitrate in one 250-ml polyethylene bottle and cooled to 4°C. The maximum analytical holding time will be 28 days for perchlorate.

Samples for **cyanide** will be placed in one 500-mL polyethylene bottle, preserved with sodium hydroxide (sample pH>12) and chilled to 4°C. The analytical holding time for this method will be 14 days.

Samples collected for **NDMA** will be placed in 1-liter amber glass bottles and cooled to 4°C. Two liters will be collected for this analysis, and the maximum analytical/contract holding time for NDMA will be 7 days prior to extraction and 40 days following extraction.

Samples for **1,4-dioxane** analysis will be collected in unpreserved 1-liter glass amber bottles and cooled immediately after sampling to 4°C. The analytical holding time for this analysis is 7 days prior to extraction and 40 days following extraction.

Samples for **1,2,3-TCP** analysis will be collected in three 40-mL glass VOA vials acidified using HCl to lower the sample pH to less than 2. The VOC vials will be cooled immediately after sampling to 4°C. The analytical holding time for this analysis is 14 days.

Samples for **SVOC** analysis will be collected in two unpreserved 1-liter glass amber bottles and cooled immediately after sampling to 4°C. The analytical holding time for this analysis is 7 days prior to extraction and 40 days following extraction.

Samples for **nitrate and nitrite** analysis will be collected in unpreserved 0.5-liter polypropylene bottles and cooled immediately after sampling to 4°C. The analytical holding time for this analysis is 48 hours.

Samples for **TDS** analysis will be collected in unpreserved 100-ml polypropylene bottles and cooled immediately after sampling to 4°C. The analytical holding time for this analysis is 7 days.

Samples for **alkalinity** analysis will be collected in unpreserved 100-ml polypropylene bottles and cooled immediately after sampling to 4°C. The analytical holding time for this analysis is 14 days.

Samples for **ammonia and total phosphorus** analysis will be collected in 0.5-liter polypropylene bottles acidified using H₂ SO₄ to lower the sample pH to less than 2. The samples will be cooled immediately after sampling to 4°C. The analytical holding time for this analysis is 28 days.

Samples for **BOD** analysis will be collected in unpreserved 0.5-liter polypropylene bottles and cooled immediately after sampling to 4°C. The analytical holding time for this analysis is 48 hours.

Samples for **COD** analysis will be collected in unpreserved 0.5-liter polypropylene bottles and cooled immediately after sampling to 4°C. The analytical holding time for this analysis is 28 days.

Samples for **TOC** analysis will be collected in unpreserved 40-mL glass VOA vials acidified using HCl to lower the sample pH to less than 2. The samples will be cooled immediately after sampling to 4°C. The analytical holding time for this analysis is 28 days.

5.5.2 Investigation Derived Waste

Samples of **drill cuttings** from roll-off bins for VOC analysis will be collected using an Encore or equivalent sampling apparatus and container. The Encore (or equivalent) sampling apparatus will be provided by the laboratory, as will the hermetically sealed 25-gram sample containers. The sample container will be pushed into the cuttings approximately 6 inches below the previously exposed surface of the material in the roll-off bin. The exterior of the container will then be wiped with a clean towel to remove any solids and permit closure of the container. The container will be closed according to the manufacturer's instructions. Sample ID information will be filled out on the back of the re-closable (originally hermetically sealed) sample pouch, as well as on a removable sample tag. The maximum analytical holding time for VOCs will be 14 days.

Drill cutting samples for additional analyses will be collected in brass sleeves in a manner similar to the collection of samples in Encore sample containers. Samples for analysis of TTLC metals will be placed in a brass sleeve, capped with teflon tape and plastic caps, and cooled to 4°C. The maximum holding time for TTLC metals is 6 months (28 days for mercury).

Samples for analysis of TPH will be placed in brass sleeves, capped with teflon tape and plastic caps, and cooled to 4°C. The maximum holding time for TPH gasoline is 48 hours and for TPH diesel is 10 days (from collection) and 40 days (from extraction).

Samples for analysis of flashpoint and pH will be placed in a brass sleeve, capped with teflon tape and plastic caps, and cooled to 4°C. The maximum holding times for flashpoint is 28 days.

One **drilling fluid** sample per each water-holding tank will be collected and submitted for laboratory analysis. Each sample will be collected using a new, disposable polyethylene bailer and inert rope to fill the appropriate sample containers. After collecting drilling fluid from near the bottom of the temporary storage container, the liquid will be slowly poured from the bailer into the sample container to minimize agitation and to prevent overfilling of the container. High liquid-content drilling mud holding times are identical to drill cutting and low liquid-content holding times, except that the samples will be collected in two 1-liter amber glass bottles and cooled to 4°C.

Monitoring well development and **purge water** from each well will be stored onsite in temporary storage containers (tanks or drums) pending results from sampling. Each well

development water sample will be collected using a new, disposable polyethylene bailer and inert rope to fill the appropriate sample containers (e.g., acidified, 40-mL glass vials for VOC analysis). After collecting water from mid-depth in the temporary storage container, the water will be slowly poured from the bailer into the sample containers to minimize agitation and to prevent overfilling of the containers. Sample container requirements and analytical holding times are described in Section 5.5.2.

5.6 Decontamination

Field equipment used during groundwater sampling and aquifer testing activities will be decontaminated using the following procedure:

- Wash with non-phosphate detergent
- Rinse with methanol (groundwater sampling equipment only)
- Rinse with deionized water
- Rinse with high-performance liquid chromatography (HPLC)-grade water (groundwater sampling equipment only)
- Air dry

When a mobile submersible pump is used to sample wells without dedicated pumps, the following procedure will be used to decontaminate the pump and discharge tubing between wells:

- Submerge the pump and full length of discharge tubing in a non-phosphate detergent bath.
- Operate the pump, while submerged, to circulate detergent through the pump mechanism and discharge tubing. The pump will be operated long enough to allow a minimum of five tubing volumes to pass through the pump and discharge tubing.
- Remove the pump and tubing from the detergent bath and pump any remaining detergent back into the detergent bath or to waste. Rinse the pump and tubing with methanol. Submerge the pump and the full length of discharge tubing in a potable water bath.
- Operate the pump, while submerged, to circulate potable water through the pump mechanism and discharge tubing, and flush out remaining detergent. The pump will be operated long enough to allow a minimum of five tubing volumes to pass through the pump and discharge tubing.
- Remove the pump and tubing from the potable water bath and pump any remaining rinse water back into the potable water bath or to waste. Submerge the pump and the full length of discharge tubing in a deionized water bath.
- Operate the pump, while submerged, to circulate deionized water through the pump mechanism and discharge tubing, and flush out remaining potable water. The pump

will be operated long enough to allow a minimum of five tubing volumes to pass through the pump and discharge tubing.

- Remove the pump and tubing from the deionized water bath and pump any remaining deionized water back into the deionized water bath or to waste.

The detergent, potable water, and deionized water baths will be emptied as IDW water and replenished daily. In general, wells will be sampled in an order progressing from least VOC contamination to highest VOC contamination, to prevent cross-contamination of wells with minimal or undetectable VOC concentrations. As an alternative to the above decontamination procedure, new disposable discharge tubing may be used at each well, with the pump mechanism decontaminated by submersion and pumping within detergent, potable water, and deionized water baths, consecutively.

5.7 Containment and Disposal of IDW

The types of wastes that may be derived from the RI field activities include drill cuttings and drilling fluids from drilling activities, water from developing and purging monitoring wells before sampling, protective clothing, and trace amounts of decontamination rinsate.

5.7.1 Drill Cuttings and Drilling Fluids

Drill cuttings and drilling fluids will be sampled and analyzed to assess whether they are hazardous. To expedite disposal of wastes, a laboratory provided by EPA will provide quick turnaround of waste analyses results. If testing indicates that none of the quantified VOCs are above federal and state regulatory levels and that the pH, flashpoint, and TPH results are acceptable (i.e., the wastes are not corrosive or flammable and contain petroleum hydrocarbons below landfill limits), the cuttings and solidified drilling mud wastes will be classified as nonhazardous and disposed of at a local Class III landfill.

If, however, the drill cuttings are classified as hazardous waste, then the bins will be hauled to a hazardous waste disposal facility approved to receive Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) wastes. Free liquids may be removed from the drill cuttings by solidification at each well site. The solidification process would involve pumping all free liquids off the drill cuttings and allowing the drill cuttings to solidify through natural evaporation.

If nonhazardous, spent drilling mud will be disposed of at a local facility specializing in drilling mud disposal. Free liquids may be removed from the drilling mud by solidification at each well site. The solidification process would involve pumping all free liquids off the drill cuttings and allowing the drill cuttings to solidify through natural evaporation. Nonhazardous drilling mud may be sent to a recycler for use in plugging oil wells or to a landfill for use as landfill cover material. If, however, the drilling mud is classified as hazardous waste, the material may be hauled to a hazardous waste disposal facility approved to receive CERCLA wastes or to an approved recycling facility.

5.7.2 Extracted Water

Groundwater extracted during the well development and aquifer testing will be stored in tanks or drums onsite, depending on quantity. Low-flow sampling of monitoring wells will

potentially produce small quantities of VOC-contaminated water. This water will be temporarily stored in 55-gallon drums, properly labeled, and transported to a central location at the site. An effort will be made to separate water containing VOCs only from water containing dioxane, perchlorate, NDMA, metals, cyanide, and hexavalent chromium.

A sample will be taken from each tank (a composite sample from drums) and sent to a laboratory for VOC analysis. If the well development water sample results show that the water contains sorbing organics (VOCs and SVOCs) only, and at concentrations exceeding regulatory levels, the water will be treated onsite with a portable GAC drum to remove VOCs prior to discharge to the ground surface (e.g., street gutter or storm drain catch basin). This treatment system will be evaluated by analyzing the effluent water from the GAC drum for VOCs on a quick turnaround time basis (24 to 72 hours). The water will be allowed to settle for a few days prior to sampling and GAC treatment to allow suspended solids to settle to the bottom of the tank.

Once the GAC drums are no longer needed or have reached saturation with respect to VOCs and no longer remove VOCs in the groundwater, they will be disposed of according to applicable local, state, and federal regulations. The GAC drum supplier will sample, analyze, and profile the GAC according to applicable local, state, and federal regulations, as stipulated in a prepaid agreement with the supplier.

Removal of 1,4-dioxane, perchlorate, NDMA, metals, cyanide, and hexavalent chromium from pumped groundwater is not anticipated to be practical onsite. These compounds are expected to be encountered at elevated levels in groundwater from several wells only. If these compounds are detected above regulatory levels (see the companion QAPP), the water will be transported to an approved treatment, storage, and disposal facility (TSDF).

5.7.3 Clothing

All drilling and sampling activities included in this plan are anticipated to be performed in modified Level "D" personal protective equipment. Disposable protective clothing generated during the performance of the work will be contained in Department of Transportation-approved 55-gallon drums (i.e., 17H). The drums will be sealed and labeled to indicate site name, drilling locations, and what is being stored. If the drill cuttings and drilling mud are determined to be nonhazardous, the protective clothing will be disposed of at a local Class III landfill. If, however, the drill cuttings and/or drilling mud are classified as hazardous waste, then the drums will be hauled to a hazardous waste disposal facility approved to receive CERCLA wastes.

5.8 Sample Management Procedures and Documentation

The following section discusses various sample management procedures that will be followed during the performance of field activities. Included in these sections are procedures for sample packaging and transportation, sample labeling, and sample documentation.

5.8.1 Sample Packaging and Shipment

The sample packaging and shipment procedures are outlined below.

5.8.1.1 Preparation of Sample Coolers

The following steps will be used to prepare the sample coolers:

1. Remove all previous labels used on the cooler.
2. Seal all drain plugs with tape (inside and outside).
3. Place a cushioning layer of recyclable cornstarch popcorn or bubble wrap at the bottom of the cooler.
4. Line the cooler with a large plastic bag to contain samples.
5. Double-bag all ice in resealable plastic bags and seal.

5.8.1.2 Packing Samples in Coolers

The following steps will be used to pack the samples in coolers:

1. Place the chain-of-custody (COC) form in a resealable bag and tape to the underside of the cooler lid.
2. Make sure that all glass sample containers are packaged in bubble wrap, secured with clear mailing tape.
3. Place samples in an upright position in the cooler.
4. Place ice on top of and between the samples.
5. Fill the void space between samples with recyclable cornstarch popcorn, double-bagged ice, or bubble wrap.
6. Custody seal large plastic bag containing samples and packing material.

5.8.1.3 Closing and Shipping of Cooler

Coolers will be packed with packing material surrounding the bottles to prevent breakage during transport. Ice will be sealed in plastic bags to prevent melting ice from soaking the packing material. Sample documentation will be enclosed in sealed plastic bags taped to the underside of the cooler lid. Coolers will be secured with packing tape and custody seals as described in the steps below.

1. Tape the cooler lid with strapping tape, encircling the cooler several times.
2. Place COC seals on two sides of the lid (one in front and one on the side).
3. Place "This Side Up" arrows on the sides of the cooler.

The coolers will then be delivered to the appropriate laboratory by the sampling team or by overnight courier the day of sample collection. Each day's sample shipment will be reported to the Region IX Sample Coordination Center (RSCC) Coordinator. For Friday shipments, the RSCC must be contacted prior to 12:00 noon to coordinate with laboratories that will receive sample shipments on Saturday. Samples will only be shipped on Friday if the laboratory provides assurance that analytical holding times will not be exceeded.

5.8.2 Sample Labeling

The following information will be written on each sample container label with a permanent marker and will be covered with clear plastic tape:

- Sample location number (if CLP sticker is used)
- Case number, if applicable
- Type of analysis requested
- Preservative used
- Date and time collected

Custody seals will be placed over the lids of each sample container. Custody seals on the VOA vials will be placed around the lid to prevent covering the septum.

Immediately following sample collection, the filled sample containers with completed labels will be sealed with custody seals, placed in plastic resealable bags, and placed in a cooler containing ice. VOA vials (three vials per sample) will be wrapped together in bubble wrap, secured with tape, and placed into labeled, plastic resealable bags. All other glass bottles will be bubble-wrapped, and placed into labeled plastic resealable bags.

An example sample identification (sample ID) with an explanation follows:

OC2-MW20A-W-0-54

OC2	Prefix "OC" stands for Omega Chemical and "2" designates the operable unit (1 or 2) the sampling was conducted for; this sampling effort is conducted entirely for OU2.
MW20A	The location (well name) where the sample was taken.
W	Sampled medium: W for water or groundwater, S for soil or drill cuttings, G for soil gas or air.
0	Designation of sample type: 0 – primary sample 1 – field duplicate 2 – field blank 3 – equipment blank (rinsate) 4 – trip blank 5 – MS/MSD 6 – regulatory split
54	Sequential number denoting the order in which the sample was collected.

The codes for gas samples and regulatory split samples are included in the explanation above because they may potentially be used under this work assignment. They are not, however, part of the current effort covered by this SAP.

The IDW sample IDs will be labeled similarly, e.g., OC2-IDW-W-0-55 for waste water, OC2-IDW-S-0-56 for waste soil (drill cuttings).

5.8.3 Sample Documentation

5.8.3.1 Field Notebooks

Bound and numbered logbooks will be used to record all sampling information. Information in the logbooks will include, at a minimum, the following:

- Name and title of the recorder, and date and time of entry
- General description of weather conditions
- Personnel involved with the activities
- Photographic log, if appropriate
- Sampling location and description
- Location of duplicate and QC samples, date and time of collection, parameters to be analyzed, sample ID numbers, blank ID numbers, whether or not split samples were collected, and if so, for whom
- Condition of well being sampled
- Serial number and calibration of field instruments
- Record of parameter values obtained during purging
- Time of sampling
- Sample description
- Shipping addresses for laboratories
- Names of visitors, their associations, and purpose of visit
- Unusual activities such as departures from planned procedures
- References to important telephone calls

All logs will be completed, signed, and dated by the recorder. All information recorded in the logs will be written with waterproof ink. Corrections will be made by crossing out the error with a single horizontal line, initialing the correction, and entering the correct information. Crossed-out information must be readable.

5.8.3.2 Chain-of-Custody Forms

Chain-of-custody procedures will be used to maintain and document sample collection and possession. After sample packaging, the following one or more of the COC paperwork forms will be completed, as necessary, for the appropriate samples:

- Organic traffic report and chain-of-custody record
- Inorganic traffic report and chain-of-custody record
- EPA Region IX Chain-of-Custody Record
- Overnight shipping courier air bill

Copies of the above forms will be filled out and distributed per instructions for sample shipping and documentation in Appendix B. Completed field QA/QC summary forms will be sent to the RSCC at EPA's Region IX QAO at the conclusion of each sampling event.

5.9 Quality Control Samples

The QC samples will be collected or prepared to assist in determining data reliability. These QC samples include equipment blanks, field duplicates, field blanks, and laboratory QC samples (for MS and MSDs). The QC samples are normally collected from locations that are suspected to be of moderate contamination. The QC samples will be collected immediately following, and using the same procedures as, the collection of the target sample.

5.9.1 Equipment Blanks

Equipment blanks are collected to verify that contamination is not introduced to samples through the repeated use of sampling equipment at different sample locations. One equipment blank per sampling event will be collected from a submersible pump used to sample OU-1 wells. These wells have dedicated pump tubing, but not dedicated pumps. The pump will be decontaminated using the procedures outlined in Section 5.6 and a rinsate sample will be collected and analyzed for VOCs. Section 4 provides the number of equipment blanks expected during the scheduled events.

5.9.2 Field Duplicates

The field duplicate is an independent sample collected as close as possible to the original sample from the same source and is used to document sampling precision. Field duplicates will be labeled and packaged in the same manner as other samples so that the laboratory cannot distinguish between samples and duplicates. Field duplicates will be collected by alternately filling sample and sample duplicate containers at a location of known or suspected contamination. Each duplicate will be taken using the same sampling and preservation method as other samples. An attempt will be made to collect duplicate samples from monitoring wells that are known or suspected of containing the chemicals that are being analyzed. Section 4 of this FSP presents the number of field duplicates expected to be collected during the scheduled sampling events.

5.9.3 Field Blanks

The field blanks are collected to verify that contamination is not introduced to samples during collection, handling, or shipping of the samples. They will be prepared by pouring blank water directly into the sample bottles (true field blanks) or by pouring blank water over or through decontaminated sampling equipment (equipment blanks). Commercially prepared HPLC water will be used for organic analyses and reagent-grade deionized water for inorganic analyses using the same preservation methods and packaging and sealing procedures used during collection of groundwater samples. Field blanks will be prepared and labeled in the same manner as the field samples and sent "blind" to the laboratory. During groundwater sampling a field blank will be collected at the first sampling location each day. A blank sample will be submitted daily for VOCs analysis. Section 4 of this FSP presents the number of and type of blank samples expected to be collected during the scheduled sampling events.

5.9.4 Laboratory QC Samples

Laboratory QC samples will be collected to perform MS and MSD analyses. An MS is an aliquot of a sample spiked with a known concentration of target analytes and provides a measure of the method accuracy. The MSD is a laboratory split sample of the MS, and is used to determine the precision of the method.

Twice the normal water volume will be collected for laboratory QC samples. Laboratory QC samples will be labeled as such on sample bottles and paperwork. The MS/MSDs will be collected at the discretion of the field crew, at a frequency of one in every 20 consecutively collected samples or one per week, whichever is greater. Section 4 of this FSP presents the number of MS/MSDs expected during the scheduled sampling events.

5.9.5 Trip Blanks

Trip blanks will be used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures. A trip blank consists of a VOC vial filled in the laboratory with HPLC-grade water, transported to the sampling site, handled like an environmental sample, and returned to the laboratory for analysis. Trip blanks are not opened in the field, are prepared only when VOC samples are collected, and analyzed only for VOCs. Collection of trip blanks is not expected during the scheduled events.

5.9.6 Temperature Blanks

Temperature blanks will be included with each cooler shipment containing samples (regardless of targeted analysis) sent to the laboratory. A temperature blank consists of a VOC sample vial filled in the field with de-ionized water, handled like an environmental sample, and returned to the laboratory for analysis. The temperature blank provides a means of verifying that samples have been maintained at the proper temperature (4 °C) following collection and during transport to the laboratory.

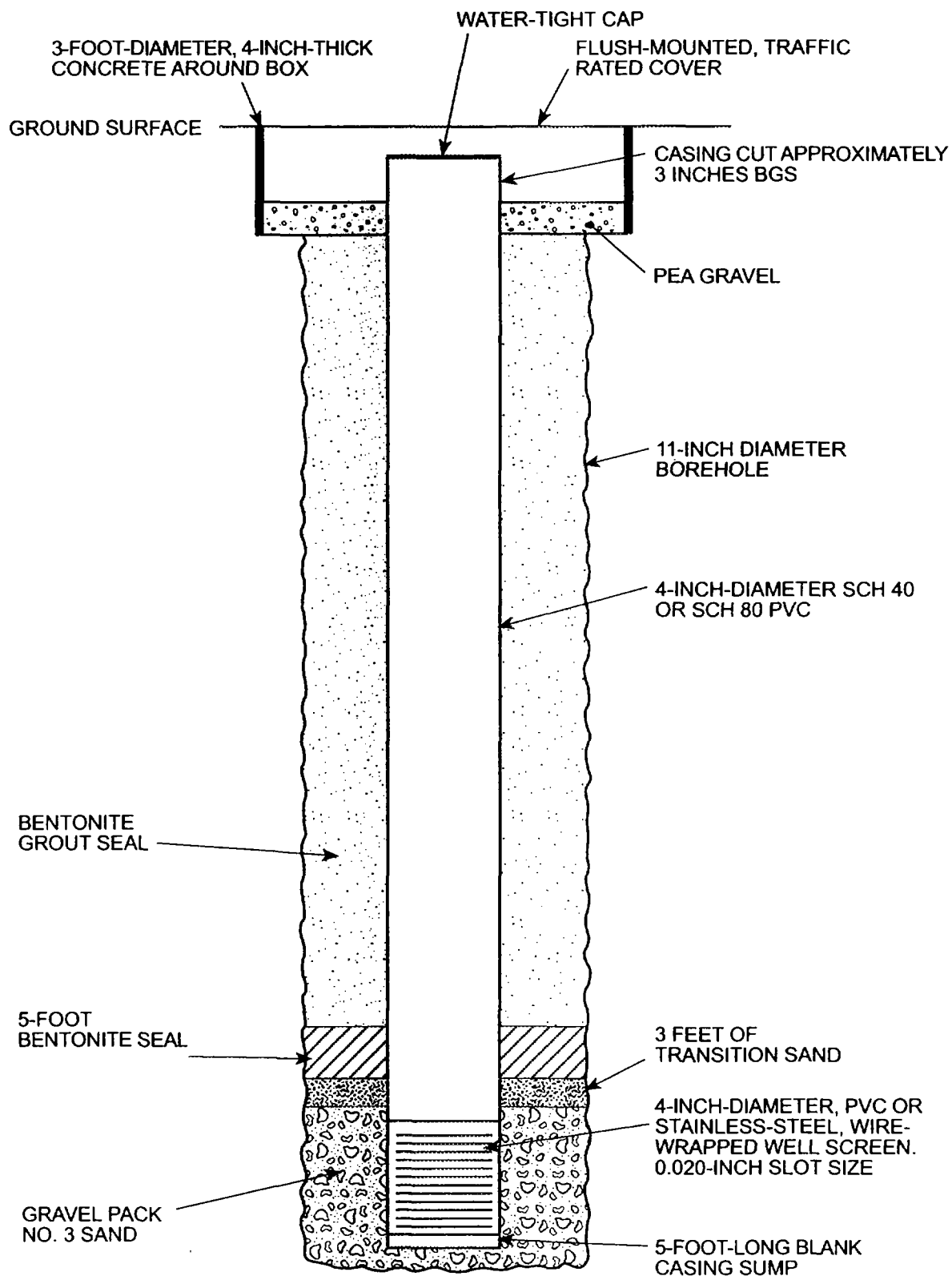
Table 5-1
Proposed Well Completion Details

Well No.	Casing Material ¹	Casing Diam. ¹	Casing Depth ²	Screen Material ¹	Screen Diam. ¹	Screen Size	Screen Depth ²
PMW12	SCH 40 or 80 PVC	2 or 4-inch	70	PVC or SST	2 or 4-inch	0.02-inch	80
PMW13	SCH 40 or 80 PVC	2 or 4-inch	70	PVC or SST	2 or 4-inch	0.02-inch	80
PMW14	SCH 40 or 80 PVC	2 or 4-inch	50	PVC or SST	2 or 4-inch	0.02-inch	60
PMW15	SCH 40 or 80 PVC	2 or 4-inch	40	PVC or SST	2 or 4-inch	0.02-inch	50
PMW16	SCH 40 or 80 PVC	2 or 4-inch	50	PVC or SST	2 or 4-inch	0.02-inch	60
PMW17A	SCH 40 or 80 PVC	2 or 4-inch	50	PVC or SST	2 or 4-inch	0.02-inch	60
PMW17B	SCH 40 or 80 PVC	2 or 4-inch	110	PVC or SST	2 or 4-inch	0.02-inch	120
PMW17C	SCH 40 or 80 PVC	2 or 4-inch	170	PVC or SST	2 or 4-inch	0.02-inch	180
PMW18	SCH 40 or 80 PVC	2 or 4-inch	60	PVC or SST	2 or 4-inch	0.02-inch	70
PMW19	SCH 40 or 80 PVC	2 or 4-inch	50	PVC or SST	2 or 4-inch	0.02-inch	60
PMW20A	SCH 40 or 80 PVC	2 or 4-inch	60	PVC or SST	2 or 4-inch	0.02-inch	70
PMW20B	SCH 40 or 80 PVC	2 or 4-inch	110	PVC or SST	2 or 4-inch	0.02-inch	120
PMW20C	SCH 40 or 80 PVC	2 or 4-inch	170	PVC or SST	2 or 4-inch	0.02-inch	180
PMW21	SCH 40 or 80 PVC	2 or 4-inch	60	PVC or SST	2 or 4-inch	0.02-inch	70
PMW22	SCH 40 or 80 PVC	2 or 4-inch	50	PVC or SST	2 or 4-inch	0.02-inch	60
PEW1	SCH 40 or 80 PVC	4-inch	60	PVC	4-inch	0.02 or 0.03-inch	80

Notes:

¹ Single screen monitoring wells will be installed with 4-inch diameter SCH40 PVC casing and 4-inch diameter 0.02-inch slot PVC screen. Single screen wells installed in areas of high concentrations of chlorinated hydrocarbons (>1000 ppb) may be installed with SCH80 PVC casing and Type 316 stainless steel (SST), continuous wire wrapped, 0.02-inch slot well screen. Multiple casing monitoring wells will be installed with 2-inch diameter SCH80 PVC casing and 2-inch diameter PVC screen.

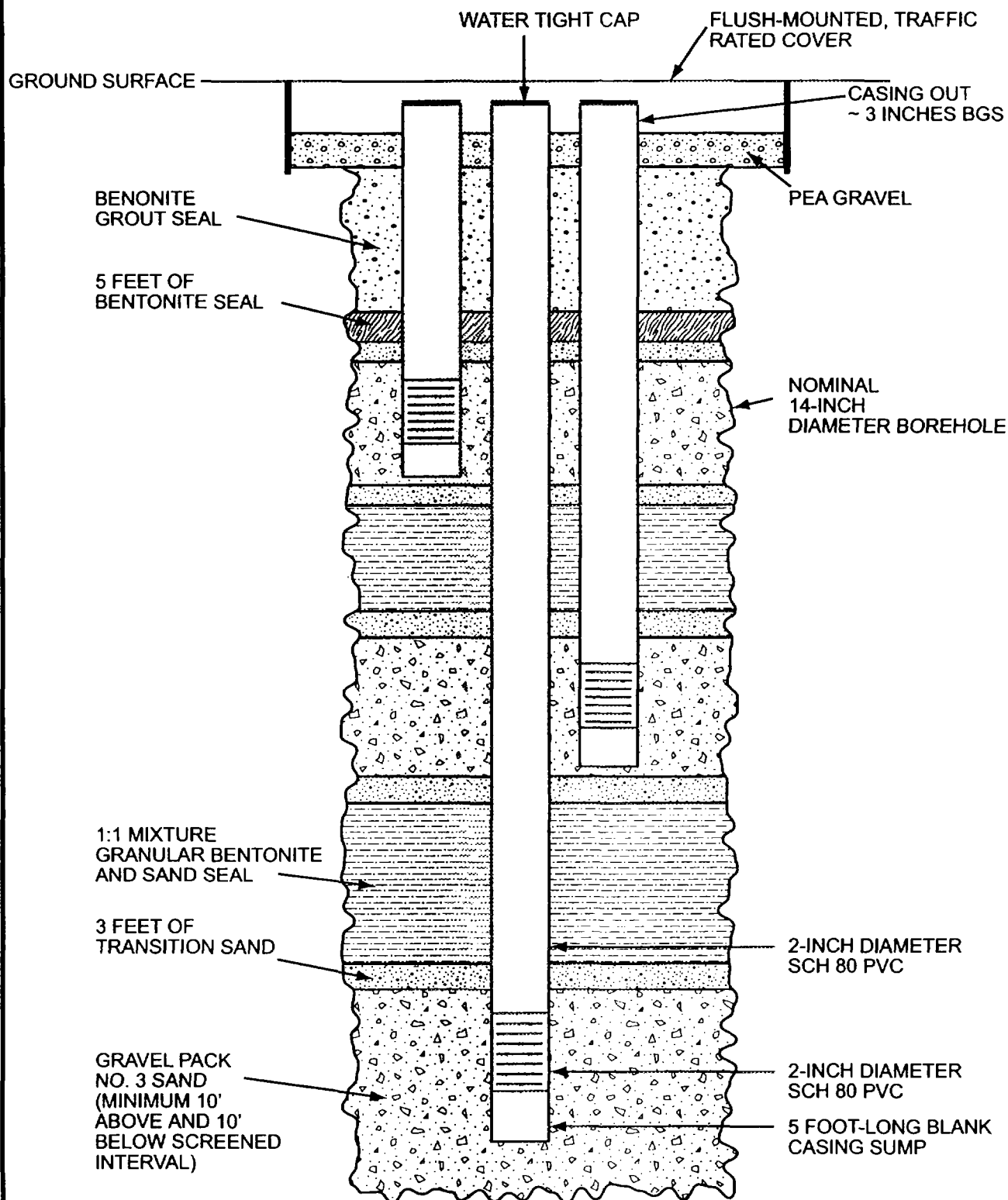
² Casing and screen depths may be modified pending site-specific hydrogeological conditions and discrete-depth sampling results.



NOT TO SCALE

Figure 5-1
Typical Single Casing
Well Completion Diagram
 Omega Chemical Superfund Site

CH2MHILL



NOT TO SCALE

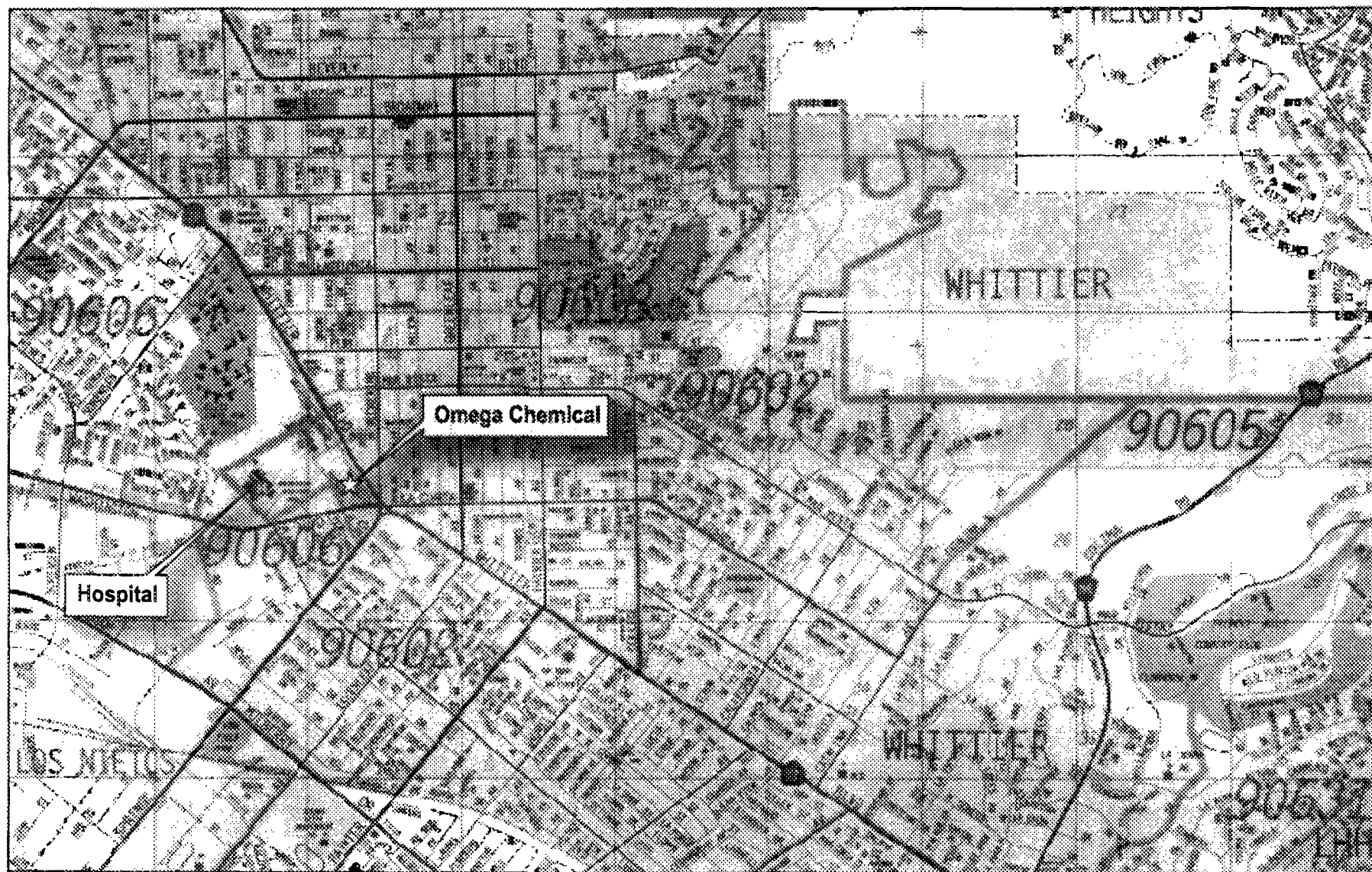
Figure 5-2
Typical Multiple Casing
Well Completion Diagram
 Omega Chemical Superfund Site

CH2MHILL

SECTION 6

Health and Safety Plan

The Health and Safety Plan for the activities described in this FSP is provided in Appendix C. A hospital location map is provided as Figure 6-1.



0 0.5
Scale in Miles

Source: Thomas Guide, Los Angeles and Orange Counties, 2003

Figure 6-1
Hospital Route Map
Omega Chemical Superfund Site
12504 E. Whittier Boulevard
Whittier, California

CH2MHILL

SECTION 7

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Appendix A

Target Compound Lists and Reporting Limits

APPENDIX A

Data Needs and Uses


Quality Assurance Project Plan, Omega OU-2

Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾	Additional Regulatory Limits (µg/L)
TCL Volatile Organic Compounds					
Acetone	Exceedances with respect to federal and state drinking water standards, and state action levels. Evaluate water treatment system design. Evaluate remedial action performance.	1	CA Primary MCL ^(A)	0.5	0.15 ^(E)
Benzene		100	USEPA Primary MCL ^(C)	0.5	2.5 ^(I) ; 100-proposed ^(A)
Bromodichloromethane		100	USEPA Primary MCL ^(C)	0.5	45 ^(I) ; 100-proposed ^(A)
Bromoform		500	CA Proposition 65 Regulatory Level ^(I)	0.5	
Bromomethane		260	CA DHS State Action Level ^(F)		
n-Butylbenzene		260	CA DHS State Action Level ^(F)		
sec-Butylbenzene		160	CA DHS State Action Level ^(F)		
Carbon disulfide		0.5	CA Primary MCL ^(A)	0.5	0.1 ^(E)
Carbon tetrachloride		100	USEPA Primary MCL ^(C)		50 ^(H)
Chlorobenzene		16	Other Taste and Odor ^(H)	0.5	100 ^(I)
Chloroethane			No Applicable ARAR		
Chloroform		140	CA DHS State Action Level ^(F)		
Chloromethane		140	CA DHS State Action Level ^(F)		
2-Chlorotoluene					
4-Chlorotoluene		0.2	USEPA Primary MCL ^(C)		0.05 ^(I)
Cyclohexane		0.05			0.1 ^(I)
Dibromomethane		600	CA DHS State Action Level ^(G)	0.5	600 ^(E)
Dibromochloromethane		600	CA DHS State Action Level ^(G)	0.5	600 ^(F)
Dibromochloropropane (DBCP)		5	CA Primary MCL ^(A)	0.5	6 ^(E)
1,2-Dibromoethane		1,000	CA DHS State Action Level ^(F)		
1,2-Dichlorobenzene					
1,3-Dichlorobenzene					
1,4-Dichlorobenzene					
Dichlorodifluoromethane					

APPENDIX A

Data Needs and Uses



Quality Assurance Project Plan, Omega OU-2

Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾	Additional Regulatory Limits (µg/L)
1,1-Dichloroethane	Exceedances with respect to federal and state drinking water standards, and state action levels.	5	CA Primary MCL ^(A)	0.5	3 ^(E)
1,2-Dichloroethane		0.5	CA Primary MCL ^(A)	0.5	0.4 ^(E)
1,1-Dichloroethylene		6	CA Primary MCL ^(A)	0.5	7 ^(C) ; 10 ^(E)
cis-1,2-Dichloroethylene	Evaluate water treatment system design.	6	CA Primary MCL ^(A)	0.5	70 ^(C)
trans-1,2-Dichloroethylene		10	CA Primary MCL ^(A)	0.5	100 ^(C)
Dichloromethane (Methylene Chloride)	Evaluate remedial action performance.	5	CA/USEPA Primary MCL ^(A) ^(C)	0.5	4 ^(E)
1,2-Dichloropropane		5	CA/USEPA Primary MCL ^(A) ^(C)	0.5	0.5 ^(E)
2,2-Dichloropropane					
1,1-Dichloropropene					
1,3-Dichloropropene		0.5	CA Primary MCL ^(A)		
cis-1,3-Dichloropropene		0.5	CA Primary MCL ^(A)	0.5	0.2 ^(E)
trans-1,3-Dichloropropene		0.5	CA Primary MCL ^(A)	0.5	0.2 ^(E)
Ethane					
Ethene					
Ethylbenzene		300	CA Primary MCL ^(A)	0.5	700 ^(C) ; 300 ^(E) ; 29 ^(H)
Hexachlorobutadiene					
2-Hexanone					
Isopropylbenzene (Cumene)		770	CA DHS State Action Level ^(F)	0.5	
Methane					
Methyl acetate					
Methyl ethyl ketone		8,400	Other Taste and Odor ^(H)	5	
Methyl isobutyl ketone (MIBK)		120	CA DHS State Action Level ^(F)		1300 ^(H)
Methylcyclohexane					
Napthalene		170	CA DHS State Action Level ^(F)		
n-Propylbenzene		260	CA DHS State Action Level ^(F)		

APPENDIX A

Data Needs and Uses


Quality Assurance Project Plan, Omega OU-2

Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾	Additional Regulatory Limits (µg/L)
Styrene	Exceedances with respect to federal and state drinking water standards, and state action levels.	100	CA/USEPA Primary MCL ^{(A) (C)}	0.5	11 ^(H)
1,1,2,2-Tetrachloroethane		1	CA Primary MCL ^(A)	0.1	0.5 ^(E) ; 1.5 ^(I)
Tetrachloroethylene (PCE)		5	CA/USEPA Primary MCL ^{(A) (C)}	0.5	0.06 ^(E)
Toluene		150	CA Primary MCL ^(A) /CA PHG ^(E)	0.5	42 ^(H) ; 1,000 ^(C)
1,2,3-Trichlorobenzene	Evaluate water treatment system design.				
1,2,4-Trichlorobenzene	Evaluate remedial action performance.	5	CA Primary MCL ^(A) /CA PHG ^(E)	0.5	70 ^(C)
1,1,1-Trichloroethane (1,1,1- TCA)		200	CA/USEPA Primary MCL ^{(A) (C)}	0.5	
1,1,2-Trichloroethane		5	CA/USEPA Primary MCL ^{(A) (C)}	0.5	5 ^(I)
Trichloroethylene (TCE)		5	CA/USEPA Primary MCL ^{(A) (C)}	0.5	0.8 ^(E)
Trichlorofluoromethane		150	CA Primary MCL ^(A)	5	700 ^(E)
1,1,2-Trichloro-1,2,2- trifluoroethane (Freon 113)		1,200	CA Primary MCL ^(A)	10	4,000 ^(E)
1,2,4-Trimethylbenzene		330	CA DHS State Action Level ^(F)		
1,3,5-Trimethylbenzene		330	CA DHS State Action Level ^(F)		
Vinyl chloride		0.5	CA Primary MCL ^(A)	0.5	0.05 ^(E) ; 2 ^(C)
Xylene(s)		1,750	CA Primary MCL ^(A)	1,800	17 ^(H) ; 10,000 ^(C)
Additional Volatiles					
Methyl tert-butyl ether (MTBE)	Exceedances with respect to federal and state drinking water standards, and state action levels	13	CA Secondary MCL ^(B)	3	13 ^(E)

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Quality Assurance Project Plan, Omega OU-2

Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾	Additional Regulatory Limits (µg/L)
TCL Semivolatile Organic Compounds					
Acenaphthene	Exceedances with respect to federal and state drinking water standards, and state action levels.				
Acenaphthylene					
Acetophenone					
Aniline (Phenylamine) (Aminobenzene)	Evaluate water treatment system design.				
Anthracene	Evaluate remedial action performance.				
Benzaldehyde					
Benzoic Acid (Carboxybenzene)		0.2	CA/USEPA Primary MCL ^{(A) (C)}	0.1	0.004 ^(E)
Benzo(a)anthracene					
Benzo(a)pyrene					
Benzo(b)fluoranthene					
Benzo(g,h,i)perylene					
Benzo(k)fluoranthene					
Benzyl Alcohol (Phenylmethanol)					
1,1'-Biphenyl					
Bis(2-chloroethoxy)methane					
Bis(2-chloroethyl)ether					
Bis(2-chloroisopropyl)ether					
4-Bromophenyl-phenyl ether					
Butylbenzyl phthalate (BBP)					
Caprolactam					
Carbazole					
4-Chloro-3-methylphenol					
4-Chloroaniline					

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Quality Assurance Project Plan, Omega OU-2

Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾	Additional Regulatory Limits (µg/L)
2-Chloronaphthalene	Exceedances with respect to federal and state drinking water standards, and state action levels.				
2-Chlorophenol					
4-Chlorophenyl-phenyl ether					
Chrysene	Evaluate water treatment system design.	400	CA/USEPA Primary MCL ^(A) ^(C)	5	200 ^(E)
Di(2-ethylhexyl)adipate	Evaluate remedial action performance.	4	CA Primary MCL ^(A)	3	6 ^(C) ; 12 ^(E)
Di(2-ethylhexyl)phthalate					
Dibenz(a,h)anthracene					
Dibenzofuran (Diphenylene oxide)					
3,3'-Dichlorobenzidine					
2,4-Dichlorophenol					
Diethyl phthalate (DEP)					
Dimethyl phthalate					
2,4-Dimethylphenol					
4,6-Dinitro-2-methylphenol					
2,4-Dinitrophenol					
2,4-Dinitrotoluene					
2,6-Dinitrotoluene					
Di-n-butylphthalate (Dibutyl phthalate)					
Di-n-octylphthalate(Dioctyl phthalate)					
Endothall					
Fluoranthene (Idryl)					
Fluorene					
Glyphosate					
Hexachlorobenzene					

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Quality Assurance Project Plan, Omega OU-2

Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾	Additional Regulatory Limits (µg/L)
Hexachlorocyclopentadiene	Exceedances with respect to federal and state drinking water standards, and state action levels. Evaluate water treatment system design. Evaluate remedial action performance. ↓	50	CA/USEPA Primary MCL ^{(A) (C)}	1	50 ^(E)
Hexachloroethane					
Indeno(1,2,3-cd)pyrene					
Isophorone					
2-Methylnaphthalene					
2-Methylphenol					
4-Methylphenol					
3,4-Methylphenol					
2-Nitroaniline					
3-Nitroaniline					
2-Nitrophenol					
4-Nitroaniline					
4-Nitrophenol					
Pentachlorophenol		1	CA/USEPA Primary MCL ^{(A) (C)}	0.2	0.4 ^(E)
Phenanthrene					
Phenol		4,200	CA DHS State Action Level ^(F)		
Pyrene					
Pyridine					
2,4,6-Trichlorophenol					
2,4,5-Trichlorophenol					
Emergent Compounds	Exceedances with respect to federal and state drinking water standards, and state action levels. Evaluate water treatment system design.				
1,4-Dioxane		3	CA DHS State Action Level ^(F)		15 ^(I)
N-Nitrosodimethylamine (NDMA)		0.01	CA DHS State Action Level ^(F)		0.02 ^(I)
1,2,3-Trichloropropane (1,2,3-TCP)		0.005	CA DHS State Action Level ^(F)		

APPENDIX A**Data Needs and Uses****Quality Assurance Project Plan, Omega OU-2**

Compound	Uses/Decisions	Applicable Regulatory Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽²⁾	Additional Regulatory Limits (µg/L)
Treatment/Discharge Parameters					
Total Organic Parameters	Evaluate groundwater treatment alternatives.				
Total Organic Carbon					
Biological Oxygen Demand	Evaluate treated groundwater discharge alternatives.				
Chemical Oxygen Demand					

Notes:

(1) ARARs from June 2003 California EPA Compilation of Water Quality Goals and Updates through September 2003.

(2) California Department of Health Services required Detection Limit for Purposes of Reporting (DLR).

(3) Calculated ARAR based on hardness = 120 mg/L as CaCO₃.

(A) California Department of Health Services Primary MCL for Drinking Water.

(B) California Department of Health Services Secondary MCL for Drinking Water.

(C) USEPA Primary MCL for Drinking Water.

(D) USEPA Secondary MCL for Drinking Water.

(E) California Office of Environmental Health Hazard Assessment Public Health Goal for Drinking Water.

(F) California Department of Health Services State Action Level for Toxicity.

(G) California Department of Health Services State Action Level for Taste and Odor.

(H) Other Taste and Odor Thresholds.

(I) California Proposition 65 Regulatory Level for Drinking Water.

APPENDIX A

Data Needs and Uses


Quality Assurance Project Plan, Omega OU-2

Compound	Uses/Decisions	Applicable Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽³⁾	Additional Regulatory Limits (µg/L)	
Emergent Compounds						
Chromium (VI)	Exceedances with respect to federal and state drinking water standards, and state action levels. Evaluate water treatment system design.	11 (0.2) ⁴	California Toxics Rule for Aquatic Life Protection ^(H)	1		
Perchlorate		4	CA DHS State Action Level ^(F)	4 (preliminary)		
TAL Inorganics						
Aluminum	Exceedances with respect to federal and state drinking water standards, and state action levels. Evaluate groundwater treatment alternatives and treated groundwater discharge options.	50	USEPA Secondary MCL ^{(D)11}	50	200 ^(B) ; 600 ^(E)	
Antimony		6	CA/USEPA Primary MCL ^{(A) (C)}	6	20 ^(E)	
Arsenic		10	USEPA Primary MCL ^(C)	2	50 ^(A) ; 0.004 ^(E)	
Barium		1,000	CA Primary MCL ^(A)	100	2,000 ^{(C) (E)}	
Beryllium		4	CA/USEPA Primary MCL ^{(A) (C)}	1	1 ^(E)	
Cadmium		5	CA/USEPA Primary MCL ^{(A) (C)}	1	0.07 ^(E) ; 2.6 ^{(3) (H)}	
Calcium						
Chromium (total)		50	CA Primary MCL ^(A)	10	100 ^(C)	
Cobalt						
Copper		11 ⁽²⁾	California Toxics Rule for Aquatic Life Protection ^(H)	50	170 ^(E) ; 1300 ^(F)	
Iron		300	CA/USEPA Secondary MCL ^{(B) (D)}	100		
Lead		3.1	California Toxics Rule for Aquatic Life Protection ^(H)	5	15 ^(F) ; 2 ^(E) ; 0.25 ^(G)	
Magnesium						
Manganese		50	CA/USEPA Secondary MCL ^{(B) (D)}	20		
Mercury		2	CA/USEPA Primary MCL ^{(A) (C)}	1	1.2 ^(E)	
Molybdenum						
Nickel		61	California Toxics Rule for Aquatic Life Protection ^(H)	10	100 ^(A) ; 12 ^(E)	
Potassium						
Selenium	5	California Toxics Rule for Aquatic Life Protection ^(H)	5	50 ^{(A) (C)}		

APPENDIX A

Data Needs and Uses

Quality Assurance Project Plan, Omega OU-2

Compound	Uses/Decisions	Applicable Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽³⁾	Additional Regulatory Limits (µg/L)				
Silver	Exceedances with respect to federal and state drinking water standards, and state action levels.	4.7 ⁽²⁾	California Toxics Rule for Aquatic Life Protection ^(I)	10	100 ^{(B) (D)}				
Sodium									
Thallium		2.0	CA/USEPA Primary MCL ^{(A) (C)}	1	0.1 ^(E)				
Vanadium		50	CA DHS State Action Level ^(F)	3 (preliminary)					
Zinc		140 ⁽²⁾	California Toxics Rule for Aquatic Life Protection ^(H)	50	5,000 ^{(B) (D)}				
Cyanide	Evaluate groundwater treatment alternatives and treated groundwater discharge options.	5.2	California Toxics Rule for Aquatic Life Protection ^(H)	100	200 ^(C) ; 150 ^(E)				
Additional Inorganics									
Boron	Evaluate groundwater treatment alternatives and treated groundwater discharge options	1,000	CA DHS State Action Level ^(F)						
Silicon									
Treatment/Discharge Parameters									
pH	Evaluate groundwater treatment alternatives and treated groundwater discharge options	6.5 to 8.5	USEPA Secondary MCL ^(D)						
Alkalinity									
Ammonia		500	Other Tastes and Odors ^(J)						
Bicarbonate									
Bromide	Exceedances with respect to federal and state drinking water standards, and state action levels	250,000	CA/USEPA Secondary MCL ^(B, D)						
Chloride									
Fluoride						1,000	CA PHG ^(E)	100	2,000 ^{(A) (D)}
Nitrate (as N)						10,000	USEPA Primary MCL ^(C)		10,000 ^(E)
Nitrite (as N)		1,000	CA/USEPA Primary MCL ^{(A) (C)}	400	1,000 ^(E)				
Phosphorus (orthophosphate, total phosphorus)									
Sulfate		250,000	CA Secondary MCL ^(B)	500	250,000 ^(D)				

APPENDIX A

Data Needs and Uses

Quality Assurance Project Plan, Omega OU-2

Compound	Uses/Decisions	Applicable Limit (µg/L)	Applicable ARAR ⁽¹⁾	California DHS DLR (µg/L) ⁽³⁾	Additional Regulatory Limits (µg/L)
Total dissolved solids (TDS)	Evaluate groundwater treatment alternatives and treated groundwater discharge options Exceedances with respect to federal and state drinking water standards, and state action levels	250,000	CA/USEPA Secondary MCL ^(B,D)		

NOTES:

(1) ARARs from June 2003 California EPA Compilation of Water Quality Goals and Updates through September 2003.

(2) Calculated ARAR based on hardness = 120 mg/L as CaCO₃.

(3) California Department of Health Services required Detection Limit for Purposes of Reporting (DLR).

(4) 0.2 µg/L detection level is needed for comparability to other databases in the region per previous DHS limit.

(A) California Department of Health Services Primary MCL for Drinking Water.

(B) California Department of Health Services Secondary MCL for Drinking Water.

(C) USEPA Primary MCL for Drinking Water.

(D) USEPA Secondary MCL for Drinking Water.

(E) California Office of Environmental Health Hazard Assessment Public Health Goal for Drinking Water.

(F) California Department of Health Services State Action Level for Toxicity.

(G) California Proposition 65 Regulatory Level for Drinking Water.

(H) California Toxics Rule for Freshwater Aquatic Life Protection - Continuous (4-day average) Concentration.

(I) California Toxics Rule for Freshwater Aquatic Life Protection - Maximum (1-hr average) Concentration.

(J) Other Taste and Odor Thresholds.

Appendix B

Sample Shipping and Documentation Instructions

Revised Daily Sample Shipment Notification Procedure (Effective 6/1/02)

This revision supercedes all previous sample shipment notification instructions. All Friday shipments should be called into the respective points of contact by 12:00 PM Friday.

For EPA Region 9 Laboratory:

Send shipping information by e-mail to Mary O'Donnell at

Odonnell.Mary@epamail.epa.gov

or

R9RSCC@epa.gov

Contact by phone at

510-412-2389

For EPA Contract Laboratory Program:

Send shipping information by e-mail to Mary O'Donnell at

Odonnell.Mary@epamail.epa.gov

or

R9RSCC@epa.gov

Contact by phone at

510-412-2389

Region 9 may provide direct contact for the CLP laboratory.

Sample shipment information that is to be provided should include the following:

- Site Name
- Case Number
- Laboratory Name
- Shipping Date
- Carrier
- Airbill/Tracking Number
- Number of Coolers
- Number of Samples
- Sample Concentration
- Matrix
- Analyses
- Is the sampling event complete with this shipment or is it to continue?
- Any additional comments that may be relevant to the analyses or transportation of the samples.
- Sampler mobile phone number, if available.

EPA Region 9, and USACE Contact for Plan Review, Scheduling of Analytical Services, and Data Review

Contact	Services	Phone Number	Internet / Email Address
Region 9 Sample Coordination Center (R9RSCC)	Scheduling and Tracking of Region 9 Lab and CLP Analytical Services.	510-412-2389	R9RSCC@epa.gov
Richard Bauer	Region 9 Lab Analytical Services; Chemistry Team Leader, and RSCC Support	510-412-2389 510-412-2312	bauer.richard@epa.gov
Mary O'Donnell	Principal RSCC for Region 9 Lab and CLP Analytical Services	510-412-2389	odonnell.mary@epa.gov
Fred Cordini	Region 9 Lab Sample Receiving Custodian and RSCC Backup	510-412-2389 510-412-2323	cordini.fred@epa.gov
Greg Nagle	Region 9 Lab Field Services	510-412-2334	nagle.greg@epa.gov
Steve Remaley	Special CLP Analytical Services (Dioxins, Asbestos, etc.) and Results; CLP Technical Project Officer	(415) 972-3802	remaley.steve@epa.gov
David Taylor	Quality Assurance Plan Review Team Leader in Region 9 Quality Assurance Office	(415) 972-3803	taylor.david@epa.gov
Rose Fong	CLP Data Review and Validation Services	(415) 972-3812	fong.rose@epa.gov
Carl Brickner	Region 9 Lab Data Review and Validation Services; Data Quality Assessment	(415) 972-3814	brickner.carl@epa.gov
John Yaremchuk	QA Chemist; US Army Corps of Engineers (USACE) Coordinator for EPA Region 9 Superfund-USACE, Sacramento District Interagency Agreement (IAG) for Special Analytical Services	916-557-7504	John.W.Yaremchuk@usace.army.mil

Appendix C

Health and Safety Plan

CH2M HILL HEALTH AND SAFETY PLAN

This Health and Safety Plan (HSP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment I.

Project Information and Description

PROJECT NO: 183122

CLIENT: EPA

PROJECT/SITE NAME: Omega Chemical Superfund Site OU-2 Remedial Investigation Feasibility Study

SITE ADDRESS: 12504 Whittier Blvd., Whittier, CA 90602

CH2M HILL PROJECT MANAGER: Tom Perina/SBO

CH2M HILL OFFICE: Southern California

DATE HEALTH AND SAFETY PLAN PREPARED: 12/29/2003

DATE(S) OF SITE WORK: Feb. 2004- Dec. 2005

SITE ACCESS: EPA to provide site access agreements

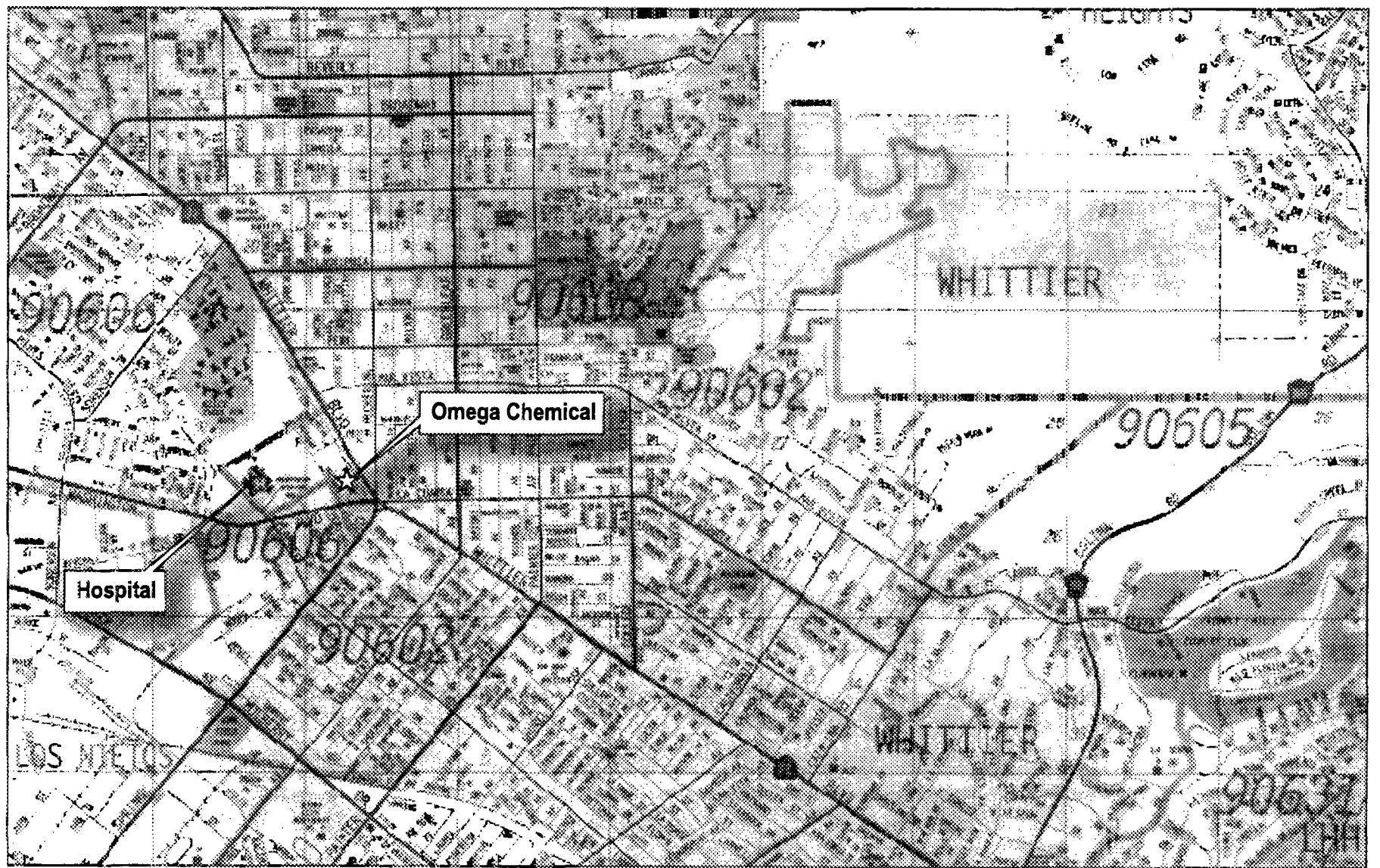
SITE SIZE: 1 acre

SITE TOPOGRAPHY: flat, paved surface, buildings, fences, on-site equipment

PREVAILING WEATHER: sunny, warm-hot

SITE DESCRIPTION AND HISTORY: The site received solvents and refrigerants for reprocessing between 1976 and 1991. Soil and groundwater contamination includes primarily perchloroethene, trichloroethene, 1,4dioxane, acetone, and freons. The highest concentration of perchloroethene found in groundwater was 50% of its solubility, indicating the likely presence of non-aqueous phase. Depth to groundwater is approximately 70 feet below ground surface. The site lithology consists of unconsolidated interbedded fluvial sediments. Fine-grained units (silts and clays) were found in the vadose zone beneath the site. Coarser units (sands) were found at and below the water table and farther away (downgradient) from the Omega property.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED: Up to thirty three groundwater monitoring wells and one extraction well will be installed to depths ranging from approximately 50 feet to 200 feet below ground surface (bgs). Soil, soil gas, and groundwater sampling will be conducted in concurrence with the well installation process. A series of aquifer tests will also be conducted after well completion.



0 0.5

Scale in Miles

Source: Thomas Guide, Los Angeles and Orange Counties, 2003

Hospital Route Map
Omega Chemical Superfund Site
12504 E. Whittier Boulevard
Whittier, California

CH2MHILL

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1 Tasks to be Performed Under this Plan

1.1 Description of Tasks

(Reference Field Project Start-up Form)

Refer to project documents (i.e., Work Plan) for detailed task information. A health and safety risk analysis (Section 1.2) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to "clean" tasks that do not involve hazardous waste operations and emergency response (Hawwoper).

1.1.1 Hawwoper-Regulated Tasks

- Drilling
- Groundwater monitoring
- Aquifer testing
- SubSurface soil sampling
- Soil Gas sampling

1.1.2 Non-Hawwoper-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hawwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hawwoper-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites.**

TASKS

- Well Installation
-
-

CONTROLS

- Brief on hazards, limits of access, and emergency procedures
- Post contaminant areas as appropriate (refer to Section 8.2 for details)
- Sample and monitor as appropriate (refer to Section 5.0)

1.2 Task Hazard Analysis

(Refer to Section 2 for hazard controls)

POTENTIAL HAZARDS	TASKS		
	Drilling, geoprobe, and well installation & abandonment	Groundwater monitoring, aquifer testing	Subsurface soil and soil gas sampling
Flying debris/objects	X		X
Noise > 85dBA	X		X
Electrical	X	X	X
Suspended loads	X		X
Buried utilities, drums, tanks	X		X
Slip, trip, fall	X	X	X
Back injury	X	X	X
Confined space entry			X
Trenches / excavations			X
Visible lightning	X	X	X
Vehicle traffic			X
Elevated work areas/falls			X
Fires	X		X
Entanglement	X		
Drilling	X		
Heavy equipment	X		X

2 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SSC for clarification.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 5. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Project-specific frequency for completing self-assessments: MONTHLY

2.1 Project-Specific Hazards

2.1.1 Drilling

(Reference CH2M HILL SOP HS-35, *Drilling*)

- Only authorized personnel are permitted to operate drill rigs.
- Stay clear of areas surrounding drill rigs during every startup.
- Stay clear of the rotating augers and other rotating components of drill rigs.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel.
- Do not wear loose-fitting clothing or other items such as rings or watches that could get caught in moving parts. Long hair should have it restrained.
- If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party shall be contacted to have line de-energized prior to approaching the equipment.
- Smoking around drilling operations is prohibited.

2.1.2 Exposure to Public Vehicular Traffic

The following precautions must be taken when working around traffic, and in or near an area where traffic controls have been established by a contractor.

- Exercise caution when exiting traveled way or parking along street – avoid sudden stops, use flashers, etc.
- Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier.
- All staff working adjacent to traveled way or within work area must wear reflective/high-visibility safety vests.
- Eye protection should be worn to protect from flying debris.
- Remain aware of factors that influence traffic related hazards and required controls – sun glare, rain, wind, flash flooding, limited sight-distance, hills, curves, guardrails, width of shoulder (i.e., breakdown lane), etc.
- Always remain aware of an escape route -- behind an established barrier, parked vehicle, guardrail, etc.
- Always pay attention to moving traffic – never assume drivers are looking out for you
- Work as far from traveled way as possible to avoid creating confusion for drivers.
- When workers must face away from traffic, a “buddy system” should be used, where one worker is looking towards traffic.
- When working on highway projects, obtain a copy of the contractor’s traffic control plan.
- Work area should be protected by a physical barrier – such as a K-rail or Jersey barrier.

- Review traffic control devices to ensure that they are adequate to protect your work area. Traffic control devices should: 1) convey a clear meaning, 2) command respect of road users, and 3) give adequate time for proper traffic response. The adequacy of these devices are dependent on limited sight distance, proximity to ramps or intersections, restrictive width, duration of job, and traffic volume, speed, and proximity.
- Either a barrier or shadow vehicle should be positioned a considerable distance ahead of the work area. The vehicle should be equipped with a flashing arrow sign and truck-mounted crash cushion (TMCC). All vehicles within 40 feet of traffic should have an orange flashing hazard light atop the vehicle.
- Except on highways, flaggers should be used when 1) two-way traffic is reduced to using one common lane, 2) driver visibility is impaired or limited, 3) project vehicles enter or exit traffic in an unexpected manner, or 4) the use of a flagger enhances established traffic warning systems.
- Lookouts should be used when physical barriers are not available or practical. The lookout continually watches approaching traffic for signs of erratic driver behavior and warns workers. Vehicles should be parked at least 40 feet away from the work zone and traffic. Minimize the amount of time that you will have your back to oncoming traffic.

2.2 General Hazards

2.2.1 General Practices and Housekeeping

(Reference CH2M HILL SOP HS-20, *General Practices*)

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness require enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

2.2.2 Hazard Communication

(Reference CH2M HILL SOP HS-05, *Hazard Communication*)

The SSC is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using Attachment 2.
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 3.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

2.2.3 Shipping and Transportation of Chemical Products

(Reference CH2M HILL's *Procedures for Shipping and Transporting Dangerous Goods*)

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

2.2.4 Lifting

(Reference CH2M HILL SOP HS-29, *Lifting*)

- Proper lifting techniques must be used when lifting any object.
 - Plan storage and staging to minimize lifting or carrying distances.
 - Split heavy loads into smaller loads.
 - Use mechanical lifting aids whenever possible.
 - Have someone assist with the lift -- especially for heavy or awkward loads.
 - Make sure the path of travel is clear prior to the lift.

2.2.5 Fire Prevention

(Reference CH2M HILL SOP HS-22, *Fire Prevention*)

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must:
 - be maintained in a fully charged and operable condition,
 - be visually inspected each month, and
 - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

2.2.6 Electrical

(Reference CH2M HILL SOP HS-23, *Electrical*)

- Only qualified personnel are permitted to work on unprotected energized electrical systems.
- Only authorized personnel are permitted to enter high-voltage areas.
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- All temporary wiring, including extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
 - equipped with third-wire grounding.
 - covered, elevated, or protected from damage when passing through work areas.
 - protected from pinching if routed through doorways.
 - not fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated UL approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus ½ inch for every 1 kV over 50 kV.
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

2.2.7 Stairways and Ladders

(Reference CH2M HILL SOP HS-25, *Stairways and Ladders*)

- Stairway or ladder is generally required when a break in elevation of 19 inches or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways; if unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Only one person at a time shall climb on or work from an individual ladder.
- User must face the ladder when climbing; keep belt buckle between side rails
- Ladders shall not be moved, shifted, or extended while in use.
- User must use both hands to climb; use rope to raise and lower equipment and materials
- Straight and extension ladders must be tied off to prevent displacement
- Ladders that may be displaced by work activities or traffic must be secured or barricaded
- Portable ladders must extend at least 3 feet above landing surface
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder
- Stepladders are to be used in the fully opened and locked position
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder
- Fixed ladders \geq 24 feet in height must be provided with fall protection devices.
- Fall protection should be considered when working from extension, straight, or fixed ladders greater than six feet from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder side rails.

2.2.8 Heat Stress

(Reference CH2M HILL SOP HS-09, *Heat and Cold Stress*)

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SSC/DSC to avoid progression of heat-related illness.

SYMPTOMS AND TREATMENT OF HEAT STRESS					
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations	Painful spasms in muscles used during work (arms, legs, or abdomen); onset	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral

SYMPTOMS AND TREATMENT OF HEAT STRESS					
		during heat exposure.	during or after work hours.	pulse and low blood pressure; oral temperature normal or low	temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool--but not cold--water. Call ambulance, and get medical attention immediately!

Monitoring Heat Stress

These procedures should be considered when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress.

The heart rate (HR) should be measured by the radial pulse for 30 seconds, as early as possible in the resting period.

The HR at the beginning of the rest period should not exceed 100 beats/minute, or 20 beats/minute above resting pulse. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 100 beats/minute at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 100 beats/minute, or 20 beats/minute above resting pulse.

2.2.9 Cold Stress

(Reference CH2M HILL SOP HS-09, *Heat and Cold Stress*)

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in cool weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- Wind-Chill Index is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- NSC Guidelines for Work and Warm-Up Schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- Persons who experience initial signs of immersion foot, frostbite, hypothermia should consult the SSC/DSC to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS			
	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm—but not hot—water. Have victim drink warm fluids, but not coffee or alcohol. Do not break blisters. Elevate the injured area, and get	Remove victim to a warm place. Have victim drink warm fluids, but not coffee or alcohol. Get medical attention.

2.2.10 Compressed Gas Cylinders

- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured in an upright position at all times.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.

2.2.11 Procedures for Locating Buried Utilities

Local Utility Mark-Out Service

Name: Underground Service Alert

Phone: 1-800-227-2600

- Where available, obtain utility diagrams for the facility.
- Review locations of sanitary and storm sewers, electrical conduits, water supply lines, natural gas lines, and fuel tanks and lines.
- Review proposed locations of intrusive work with facility personnel knowledgeable of locations of utilities. Check locations against information from utility mark-out service.
- Where necessary (e.g., uncertainty about utility locations), excavation or drilling of the upper depth interval should be performed manually.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon).
- When the client or other onsite party is responsible for determining the presence and locations of buried utilities, the SSC should confirm that arrangement.

2.3 Biological Hazards and Controls

2.3.1 Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

2.3.2 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.3.3 Bloodborne Pathogens

(Reference CH2M HILL SOP HS-36, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.5 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum ^a Concentration (ppm)	Exposure Limit ^b	IDLH ^c	Symptoms and Effects of Exposure	PIP ^d (eV)
Chloroform	GW: 3.0 SB: SS:	2 ppm	500 Ca	Dizziness, mental dullness, nausea, confusion, disorientation, headache, fatigue, eye and skin irritation, anesthesia, enlarged liver	11.42
Chromium (as Cr(II) & Cr(III))	GW: SB: SS:	0.5 mg/m ³	25	Irritated eyes, sensitization dermatitis, histologic fibrosis of lungs	NA
Chromium (hexavalent)	GW: traces SB: SS:	0.01 mg/m ³	15 Ca	Irritated respiratory system, nasal septum perforation, liver and kidney damage, leucytosis, leupen, monocytosis, eosinophilla, eye injury, conjunctivitis, skin ulcer, sensitization dermatitis	NA
1,2-Dichloroethane (Ethylene Dichloride)	GW: 0.9 SB: SS:	1 ppm	50 Ca	CNS depression, nausea, vomiting, dermatitis, eye irritation, liver, kidney, and CNS damage; corneal opacity	11.05
Perchlorate	GW: 0.0093 SB:	NL	NL	Diminished thyroid action, irritation to the eyes, skin and mucous membranes.	ND
Tetrachloroethylene (PCE)	GW: 100 SB: 3300 ug/kg SS:	25 ppm	150 Ca	Eye, nose, and throat irritation; nausea; flushed face and neck; vertigo; dizziness; sleepiness; skin redness; headache; liver damage	9.32
1,1,1-Trichloroethane (TCA)	GW: 0.4 SB: SS:	10 ppm	100 Ca	Eye and nose irritation, CNS depression, liver damage, dermatitis	11.00
Trichlorotrifluoromethane (Freon 113)	GW: 2.3 SB: SS:	1000 ppm	2000 ppm	Irritation to skin, throat, drowsiness; dermatitis, CNS depressant/depression	
Trichlorofluoromethane (Freon 11)	GW: 0.9 SB: SS:	1000 ppm	2000 ppm	Incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest, asphyxia	
Trichloroethylene (TCE)	GW: 7.0 SB: SS:	50 ppm	1,000 Ca	Headache, vertigo, visual disturbance, eye and skin irritation, fatigue, giddiness, tremors, sleepiness, nausea, vomiting, dermatitis, cardiac arrhythmia, paresthesia, liver injury	9.45

Footnotes:

^a Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Surface Soil), SL (Sludge), SW (Surface Water).

^b Appropriate value of PEL, REL, or TLV listed.

^c IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.

^d PIP = photoionization potential; NA = Not applicable; UK = Unknown.

2.5 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum ^a Concentration (ppm)	Exposure Limit ^b	IDLH ^c	Symptoms and Effects of Exposure	PIP ^d (eV)
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2.6 Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.

Inhalation: Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.

Other: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HS-01, *Medical Surveillance*, and HS-02, *Health and Safety Training*)

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSC" have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP HS-04, *Reproduction Protection*, including obtaining a physician's statement of the employee's ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SSC/FA-CPR
Tom Perina	SBO	PM	Level D
Dan Jablonski	SBO	Field team lead,	Level D,

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Contact Name: Christopher Lichens, EPA mgr.

Phone: 415-972-3149

Facility Contact Name: 3 tenants at location

Refrigerant Exchange Corp., Dennis O'Meara

Start City Autobody, George S. 562-698-2161

C&I Electric, Virginia Parker, 562-698-6911

3.2.2 CH2M HILL

Project Manager: Tom Perina/SBO

Health and Safety Manager: Rick Cavil/SJC

Field Team Leader: Dan Jablonski/SBO

Site Safety Coordinator: Dan Jablonski/SBO

The SSC is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The Health and Safety Manager should be contacted as appropriate.

3.2.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HS-55, *Subcontractor, Contractor, and Owner*)

Subcontractor: TBD
Subcontractor Contact Name:
Telephone:

Tasks: Drilling and well installation

The subcontractors listed above are covered by this HSP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SSC is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-assessment checklists. Self-assessment checklists contained in Attachment 5 are to be used by the SSC to review subcontractor performance.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Form included in Attachment 1.
- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

3.2.4 Contractors

(Reference CH2M HILL SOP HS-55, *Subcontractor, Contractor, and Owner*)

Contractor: N/A
Contractor Contact Name:
Telephone:

This plan does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (e.g., advising on H&S issues). In addition to this plan, CH2M HILL staff should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Except in unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve contractor safety procedures. Self-assessment checklists contained in Attachment 5 are to be used by the SSC to review the contractor's performance ONLY as it pertains to evaluating our exposure and safety.

Health and safety related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL employees and subcontractors on the precautions related to the contractor's work.
- When an apparent contractor non-compliance/unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors:
 - Notify the contractor safety representative
 - Request that the contractor determine and implement corrective actions

- If needed, stop affected CH2M HILL work until contractor corrects the condition or practice. Notify the client, Project Manager, and HSM as appropriate.
- If apparent contractor non-compliance/unsafe conditions or practices are observed, inform the contractor safety representative. Our obligation is limited strictly to informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative. Our obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of our observation – the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-07, *Personal Protective Equipment*, HS-08, *Respiratory Protection*)

PPE Specifications ^a

Task	Level	Body	Head	Respirator ^b
General site entry	D	Work clothes; steel-toe, leather work boots; reflective vest; work glove.	Hardhat ^c Safety glasses Ear protection ^d	None required
Groundwater sampling Soil boring Drilling Surface and subsurface soil sampling	Modified D	Coveralls: Uncoated Tyvek® Boots: Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat ^c Splash shield ^c Safety glasses Ear protection ^d	None required.
Test pit excavation Tasks requiring upgrade	C	Coveralls: Polycoated Tyvek® Boots: Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat ^c Splash shield ^c Ear protection ^d Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent ^c .
Tasks requiring upgrade	B	Coveralls: Polycoated Tyvek® Boots: Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat ^c Splash shield ^c Ear protection ^d Spectacle inserts	Positive-pressure demand self-contained breathing apparatus (SCBA); MSA Ultralite, or equivalent.

Reasons for Upgrading or Downgrading Level of Protection

Upgrade ^f	Downgrade
<ul style="list-style-type: none"> Request from individual performing tasks. Change in work tasks that will increase contact or potential contact with hazardous materials. Occurrence or likely occurrence of gas or vapor emission. Known or suspected presence of dermal hazards. Instrument action levels (Section 5) exceeded. 	<ul style="list-style-type: none"> New information indicating that situation is less hazardous than originally thought. Change in site conditions that decreases the hazard. Change in work task that will reduce contact with hazardous materials.

^a Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

^b No facial hair that would interfere with respirator fit is permitted.

^c Hardhat and splash-shield areas are to be determined by the SSC.

^d Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.

^e Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.

^f Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SSC qualified at that level is present.

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HS-06, *Air Monitoring*)

5.1 Air Monitoring Specifications

Instrument	Tasks	Action Levels ^a	Frequency ^b	Calibration
PID: OVM with 10.6eV lamp or equivalent	During sampling tasks & drilling	<5 ppm >5 ppm >25 ppm	Level D Level C Stop work, contact HSM	Initially and periodically during task Daily
CGI: MSA model 260 or 261 or equivalent	Drilling	0-10% : 10-25% LEL: >25% LEL:	No explosion hazard Potential explosion hazard Explosion hazard; evacuate or vent	Continuous during advancement of boring or trench Daily
Nose-Level Monitor ^c :	Drilling	<85 dB(A) 85-120 dB(A) 120 dB(A)	No action required Hearing protection required Stop; re-evaluate	Initially and periodically during task Daily

^a Action levels apply to sustained breathing-zone measurements above background.

^b The exact frequency of monitoring depends on field conditions and is to be determined by the SSC; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3", "at surface/SB-2", etc.).

^c If the measured percent of O₂ is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O₂ action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O₂ action levels are required for confined-space entry (refer to Section 2).

^d Refer to SOP HS-10 for instructions and documentation on radiation monitoring and screening.

^e Noise monitoring and audiometric testing also required.

5.2 Calibration Specifications

(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
PID: OVM, 10.6 or 11.8 eV bulb	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm reg T-tubing
PID: TVA 1000	100 ppm isobutylene	CF = 1.0	100 ppm	1.5 lpm reg T-tubing
FID: OVA	100 ppm methane	3.0 ± 1.5	100 ppm	1.5 lpm reg T-tubing
FID: TVA 1000	100 ppm methane	NA	100 ppm	2.5 lpm reg T-tubing
Dust Monitor: Miniram-PDM3	Dust-free air	Not applicable	0.00 mg/m ³ in "Measure" mode	Dust-free area OR Z-bag with HEPA filter
CGI: MSA 260, 261, 360, or 361	0.75% pentane	N/A	50% LEL $\pm 5\%$ LEL	1.5 lpm reg direct tubing

5.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the HSM immediately if these contaminants are encountered.

Method Description

Personnel and Areas

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel. Results reported to:

HSM:

Other:

6 Decontamination

(Reference CH2M HILL SOP HS-13, *Decontamination*)

The SSC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SSC. The SSC must ensure that procedures are established for disposing of materials generated on the site.

6.1 Decontamination Specifications

Personnel	Sample Equipment	Heavy Equipment
<ul style="list-style-type: none">• Boot wash/rinse• Glove wash/rinse• Outer-glove removal• Body-suit removal• Inner-glove removal• Respirator removal• Hand wash/rinse• Face wash/rinse• Shower ASAP• Dispose of PPE in municipal trash, or contain for disposal• Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal	<ul style="list-style-type: none">• Wash/rinse equipment• Solvent-rinse equipment• Contain solvent waste for offsite disposal	<ul style="list-style-type: none">• Power wash• Steam clean• Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

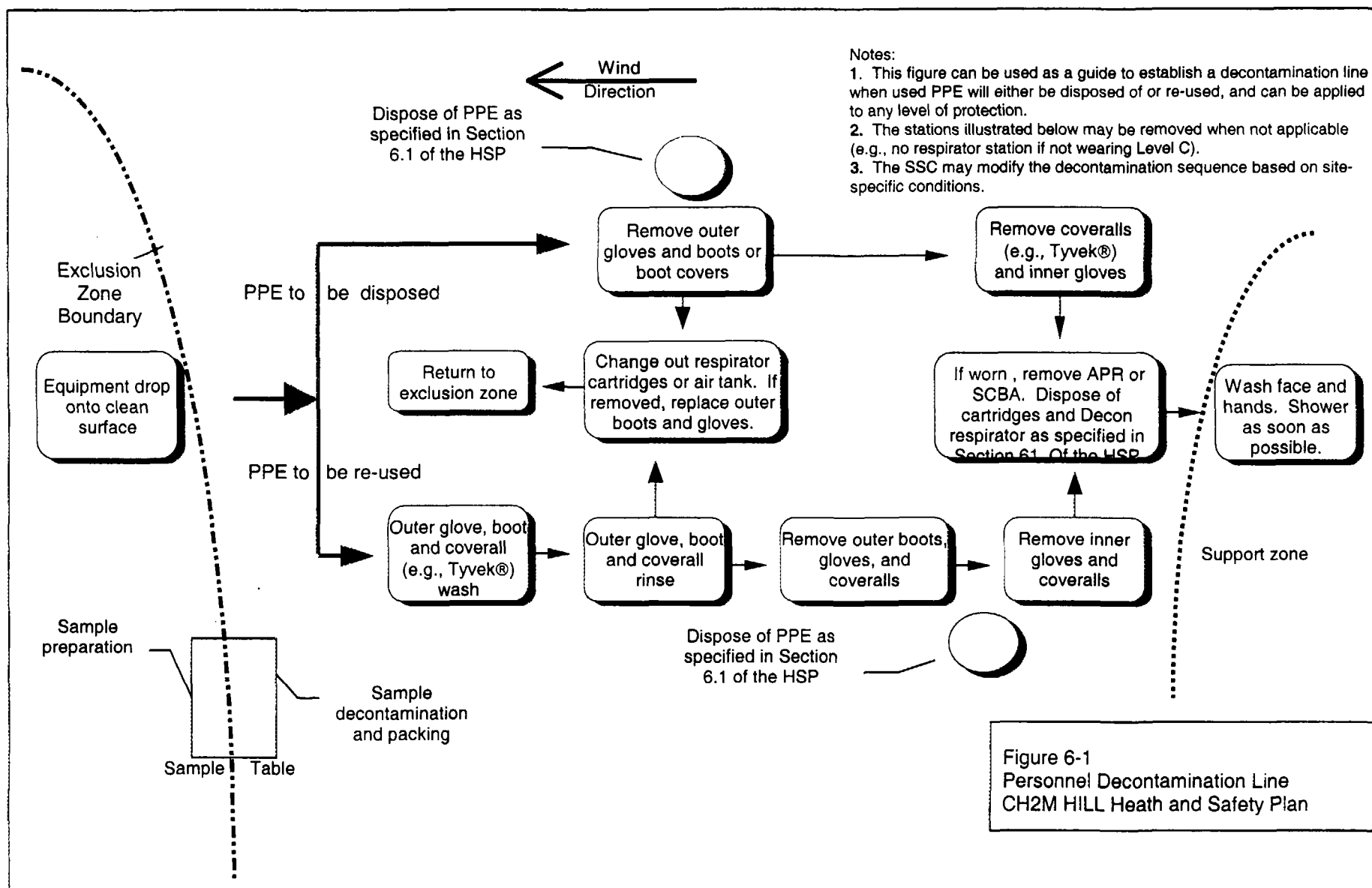
6.2 Diagram of Personnel-Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SSC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure 6-1 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SSC to accommodate task-specific requirements.

7 Spill-Containment Procedures

Sorbent material will be maintained in the support zone. Incidental spills will be contained with sorbent and disposed of properly.



8 Site-Control Plan

8.1 Site-Control Procedures

(Reference CH2M HILL SOP HS-11, *Site Control*)

- The SSC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HS-71, *OSHA Postings*.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
 - Line-of-sight and hand signals
 - Air horn
 - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the “buddy system.”
- Initial air monitoring is conducted by the SSC in appropriate level of protection.
- The SCC is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.

8.2 Hazwoper Compliance Plan

(Reference CH2M HILL SOP HS-19, *Site-Specific Written Safety Plans*)

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in Section 1.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site, or while non-Hazwoper-trained staff are working in proximity to Hazwoper activities. Other data (e.g., soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 2.5 and 5.3 for contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SSC must post the exclusion zone and inform non-Hazwoper-trained personnel of the:
 - nature of the existing contamination and its locations
 - limitations of their access
 - emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.
- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the Hazwoper standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hour of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

9 Emergency Response Plan

(Reference CH2M HILL, SOP HS-12, *Emergency Response*)

9.1 Pre-Emergency Planning

The SSC performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate.

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The SSC will evaluate emergency response actions and initiate appropriate follow-up actions.

9.2 Emergency Equipment and Supplies

The SSC should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 LB (or two 10-lb) fire extinguisher (A, B, and C classes)	Support Zone/Heavy Equipment
First aid kit	Support Zone/Field Vehicle
Eye Wash	Support & Decon Zone/Field Vehicle
Potable water	Support & Decon Zone/Field Vehicle
Bloodborne-pathogen kit	Support Zone/Field Vehicle
Additional equipment (specify):	

9.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

9.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 9.8 (e.g., 911).
- The SCC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 9.7.

9.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the SSC before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SSC and a "buddy" will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The SSC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The SSC will write up the incident as soon as possible after it occurs and submit a report to the Corporate Director of Health and Safety.

9.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

9.7 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to client as required in contract.

10 Approval

This site-specific Health and Safety Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

10.1 Original Plan

Written By: Rick Cavi/SJC

Date: 12/29/2003

Approved By: Rick Cavi/SJC

Date: 01/06/2004

10.2 Revisions

Revisions Made By: Tom Perina

Date: 02/04/04

Revisions to Plan:

Revisions Approved By:

Date:

11 Attachments

- Attachment 1: **Employee Signoff Form – Field Safety Instructions**
- Attachment 2: **Project-Specific Chemical Product Hazard Communication Form**
- Attachment 3: **Chemical-Specific Training Form**
- Attachment 4: **Emergency Contacts**
- Attachment 5: **Project Activity Self-Assessment Checklists**
- Attachment 6: **Applicable Material Safety Data Sheets**

CH2MHILL

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

- The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: Omega Chemical

Project Number: 183120[illegible]

[illegible]

CHEMICAL-SPECIFIC TRAINING FORM

Location:

Project # : 183120

HCC:

Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

- ☐ Physical and health hazards
- ☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)
- ☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

Emergency Contacts

24-hour CH2M HILL Emergency Beeper – 888/444-1226

Medical Emergency – 911

Facility Medical Response #:

Local Ambulance #:

CH2M HILL Medical Consultant

Health Resources

Dr. Jerry H. Berke, M.D., M.P.H.

600 West Cummings Park, Suite 3400

Woburn, MA 01801-6350

1-781-938-4653

1-800-350-4511

(After hours calls will be returned within 20 minutes)

Fire/Spill Emergency -- 911

Facility Fire Response #:

Local Fire Dept #:

Local Occupational Physician

Security & Police – 911

Facility Security #:

Local Police #:

Corporate Director Health, Safety & Environment

Name: Dave Waite/SEA

Phone: 425/453-5000

24-hour emergency beeper: 888-444-1226

Utilities Emergency

Water:

Gas:

Electric:

Health & Safety Manager (HSM)

Name: Rick Cavi/SJC

Phone: 408/436-4909 x429

Safety Coordinator (SC)

Name: Dan Jablonski/SBO

Phone: 909-858-8714

Regional Human Resources Department

Name: Lisa Covey/SAC

Phone: 916/920-0300 x253

Project Manager (PM)

Name: Tom Perina/SBO

Phone: 909-890-9857

Corporate Human Resources Department

Name: Pete Hannan/COR

Phone: 303/771-0900

Federal Express Dangerous Goods Shipping

Phone: 800/238-5355

Worker's Compensation:

Contact Regional HR dept. to have form completed or contact Julie Zimmerman after hours: 303/664-3304

CH2M HILL Emergency Number for Shipping Dangerous Goods

Phone: 800/255-3924

Automobile Accidents:

Rental: Carol Dietz/COR 303/713-2757

CH2M HILL owned vehicle:

Zurich Insurance Co. 800/987-3373

Contact the PM. Generally, the PM will contact relevant government agencies.

Facility Alarms:

Evacuation Assembly Area(s):

Facility/Site Evacuation Route(s):

Hospital Name/Address: Presbyterian Medical Hospital
12401 E. Washington Blvd, Whittier, CA

Hospital Phone #: 562-696-0811

Directions to Hospital

Travel west on Washington Blvd, approx. 0.25 miles. The hospital is on the right hand (north) side of Washington Blvd.

A hospital route map is provided at the back of this HASP.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 5

Project Activity Self-Assessment Checklists

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to hazards associated with drilling operations (complete Sections 1 and 3), and/or 2) CH2M HILL oversight of a drilling subcontractor is required (complete entire checklist).

SSC/DSC may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the health and safety manager for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

- ☐ Evaluate CH2M HILL employee exposures to drilling hazards
☐ Evaluate a CH2M HILL subcontractor's compliance with drilling H&S requirements

Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-35.

SECTION 1**Yes No N/A N/O****PERSONNEL SAFE WORK PRACTICES (3.1)**

- | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Only authorized personnel operating drill rig | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Personnel cleared during rig startup | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Personnel clear of rotating parts | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Personnel not positioned under hoisted loads | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Loose clothing and jewelry removed | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Personnel instructed not to approach equipment that has become electrically energized | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Smoking is prohibited around drilling operation | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Personnel wearing appropriate PPE, per HSP/FSI | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Rev.0

	<u>SECTION 2</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
GENERAL (3.2.1)					
9. Daily safety briefing/meeting conducted with crew		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Daily inspection of drill rig and equipment conducted before use		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG PLACEMENT (3.2.2)					
11. Location of underground utilities identified		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Safe clearance distance maintained from overhead powerlines		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Drilling pad established, when necessary		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Drill rig leveled and stabilized		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG TRAVEL (3.2.3)					
15. Rig shut down and mast lowered and secured prior to rig movement		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Tools and equipment secured prior to rig movement		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Only personnel seated in cab are riding on rig during movement		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Safe clearance distance maintained while traveling under overhead powerlines		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Backup alarm or spotter used when backing rig		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG OPERATION (3.2.4)					
20. Kill switch clearly identified and operational		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. All machine guards are in place		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Rig ropes not wrapped around body parts		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Pressurized lines and hoses secured from whipping hazards		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Drill operation stopped during inclement weather		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Air monitoring conducted per HSP/FSI for hazardous atmospheres		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Rig placed in neutral when operator not at controls		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILL RIG MAINTENANCE (3.2.5)					
27. Defective components repaired immediately		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. Lockout/tagout procedures used prior to maintenance		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29. Cathead in clean, sound condition		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Drill rig ropes in clean, sound condition		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Fall protection used for fall exposures of 6 feet or greater		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Rig in neutral and augers stopped rotating before cleaning		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Good housekeeping maintained on and around rig		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DRILLING AT HAZARDOUS WASTE SITES (3.2.6)					
34. Waste disposed of according to HSP		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. Appropriate decontamination procedures being followed, per HSP		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

[illegible]

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 6

Applicable Material Safety Data Sheets